VOLUME SIX

HINTS AND KINKS

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for the Radio Amateur

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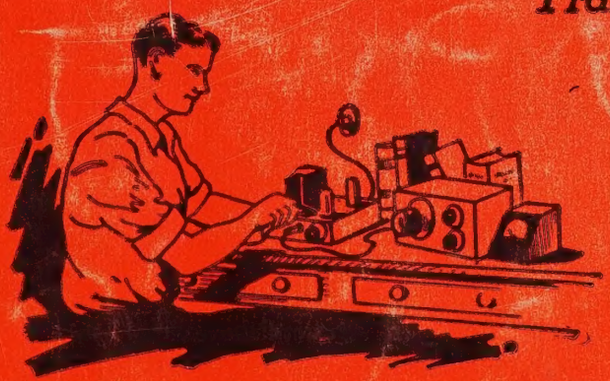

V.H.F.

Workshop

Receiver

Mobile

Shack

Keying

Phone

Monitoring

A Wealth of Practical Ideas for the Station and Workshop

PUBLISHED BY THE AMERICAN RADIO RELAY LEAGUE

A. N. McLaughlin

VOLUME SIX

Hints and Kinks

for the Radio Amateur

. . . . A Symposium of Many Practical Ideas for the Radio Amateur's Workshop and Station

PUBLISHED BY

THE AMERICAN RADIO RELAY LEAGUE, INC.

WEST HARTFORD 7, CONNECTICUT, U.S.A.

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Library of Congress Catalog Card Number: 33-14685

(Volumes I, II, III, IV and V of this publication are now out of print)

$1 in U. S. A. proper
$1.25 elsewhere

Foreword

THE SUCCESSFUL RADIO AMATEUR is, by nature, an ingenious fellow. Without a high order of resourcefulness and an ability to improvise he could never overcome the ever-present problem of inadequate workshop equipment and the equally common handicaps of insufficient apparatus and money. Evidence of this inherent ingenuity is to be seen on all sides. One cannot visit any good amateur station without finding clever improvisations, either in the construction of individual components or in the manner in which the whole station is assembled. It may be just a different way to mount a coil, or a scheme for getting a broken antenna halyard back upon the mast, or a fabulous remote-control system. Whatever the idea, it is invariably of value to the rest of us.

With the object of putting the best of these "brain storms" into circulation there has appeared in *QST*, these many years, a department devoted to the general subject of "Hints and Kinks." This department has enjoyed great popularity. The ideas contributed to it by ingenious amateurs have helped us all in our search for ways and means to improve our equipment. Unfortunately this garnered gold of amateur experimentation often has been lost to sight, shadowed by some big article or forgotten in the excitement of some major development. Then, too, there has been the annoying business of vaguely remembering a squib bearing on the problem at hand but being unable to locate it when it is most needed.

These factors led us, in 1933, to publish a collection of the best ideas, schemes and methods offered by *QST* contributors during the three years prior to that date. The first edition of *Hints and Kinks* was well received and established definitely the value of a single grouping of selected "experimental expedients," carefully classified and arranged. In 1937 a second volume of *Hints and Kinks* was published, containing a larger and more comprehensive collection of new ideas. The success of this second edition motivated the publishing of equally popular third, fourth and fifth volumes in 1945, 1949 and 1954, respectively.

Since the war — and especially because of the advent of television — much development of newer tubes, circuits and constructional practices has occurred. In addition, amateurs have found wide application in their stations for the large variety of war-surplus equipment which has made its appearance. These trends, of course, have been faithfully recorded in the pages of *QST*. Accordingly, this sixth volume of *Hints and Kinks* has been assembled to correlate in easy-reference form the best of these ideas. The material should suggest many intriguing possibilities for putting back to work older apparatus now gathering dust in cellars and attics. Above all, it should enable each of us, in one way or another, to increase the efficiency of our present-day stations.

We express our thanks to those amateurs whose willingness to offer the result of their efforts to the fraternity as a whole has made this publication possible.

A. L. BUDLONG
General Manager, A.R.R.L.

West Hartford, Conn.

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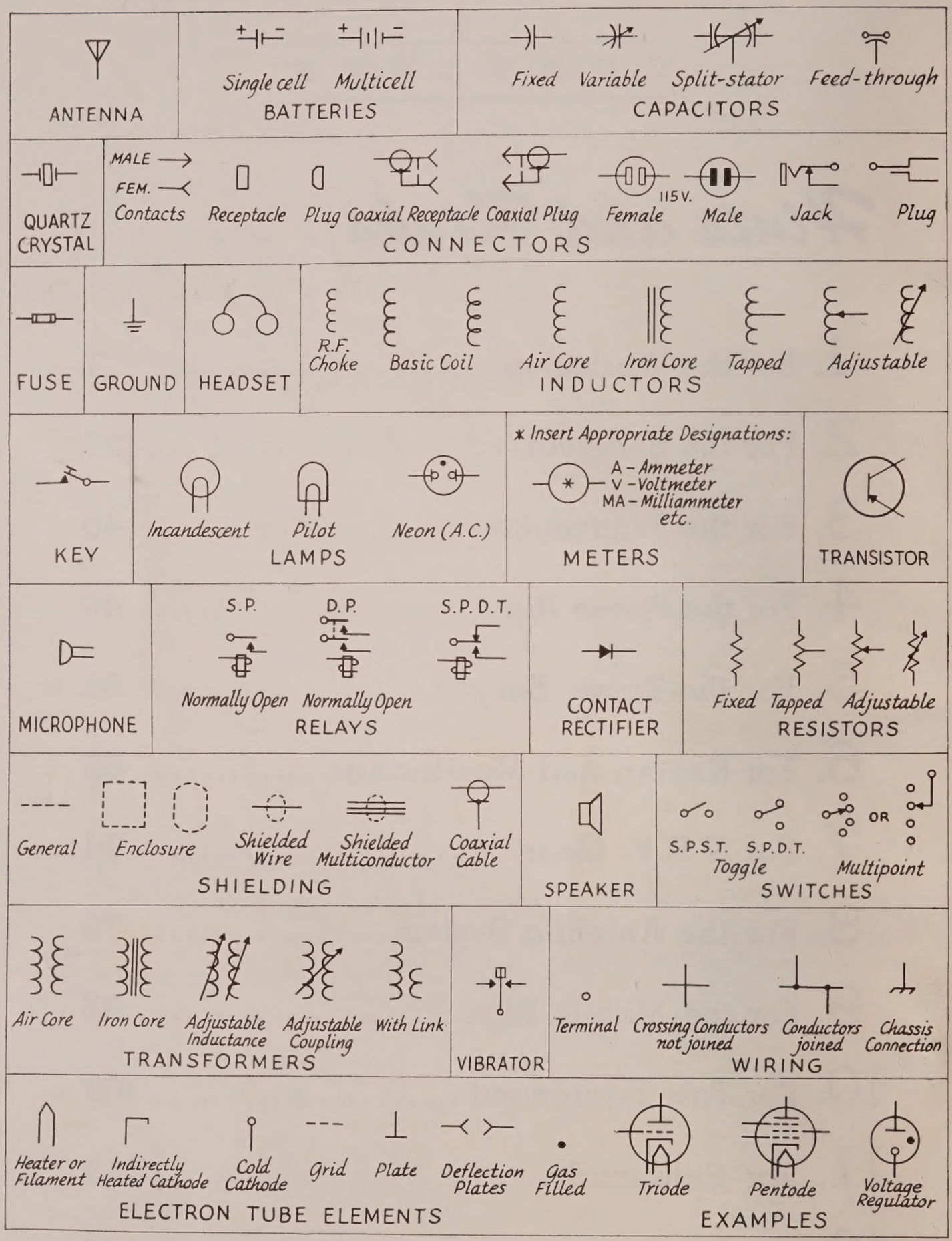
SCHEMATIC SYMBOLS USED IN CIRCUIT DIAGRAMS



Where it is necessary or desirable to identify the electrodes or capacitors, the curved element represents the *outside* electrode (marked "outside foil," "ground," etc.) in fixed paper- and ceramic-dielectric capacitors, and the *negative* electrode in electrolytic capacitors.

In the modern symbol, the curved line indicates the moving element (rotor plates) in variable and adjustable air- or mica-dielectric capacitors.

In the case of switches, jacks, etc., only the basic combinations are shown. Any combination of these symbols may be assembled as required, following the elementary forms shown.

1. Hints and Kinks . . .

for the Workshop

NEW LIFE FOR WORN SOLDERING-IRON TIPS

SOLDERING-IRON tips that have been subjected to prolonged service usually become poor conductors of heat. This condition may be remedied by cleaning away the oxide that has formed between the tip and the heating compartment of the iron. However several such treatments ordinarily reduce the diameter of the tip excessively and render it completely useless.

One method of extending the life of a tip that has been cleaned and recleaned to a state of apparent uselessness is to wrap it in a strip of flashing copper. The tip should be thoroughly cleaned before the wrapping is applied, and the fit between tip, copper and the heating barrel should be as tight as possible.

— *George Grammer, W1DF*

A TIP FOR A SOLDERING TIP

To make a soldering tip that can be used in those small out-of-the-way spots that cannot be reached with standard tips, saw off the end of a standard size tip. Drill a hole large enough to take No. 9 wire down through the center of the remaining tip. Drill another hole in the side and tap for a 6–32 set screw. Insert a piece of No. 9 wire in the center, tighten the set screw and there is your new tip.

It takes a little longer to heat up the new tip and it doesn't have the heat capacity of the old one, but for hard-to-get-at spots it does the job.

— *Ralph Arsenault, VE1AK*

SOLDERING IRON CLEANER

SOLDERING iron tips can be cleaned easily without sandpaper, files or wire brushes simply by using a Sal-Ammoniac brick. The brick can usually be purchased from hardware or plumbing supply houses. Place the hot soldering iron tip against the Sal-Ammoniac brick and the oxide coating will be removed quickly.

— *Alex Toke, K2YVQ*

HOMEMADE "HEAVY-DUTY" SOLDERING LUGS

WHEN heavy-duty soldering lugs just don't seem to be available for mobile or antenna installation work, try the following idea.

Find a piece of copper tubing having an inside diameter that will accommodate the wire to be used. Decide how many lugs you need and then cut that number of pieces — each approximately 1¼ inches long — from the tubing. Using a vise, mash flat each piece of tubing for about one half its length. After mounting holes are drilled in the flattened sections, you'll have lugs that are sturdy and easily soldered to.

— *James W. Carter, W4JAU*

SOLDERING TO ALUMINUM

CONTRARY to popular belief, it is possible to solder to aluminum. The procedure for using ordinary solder is as follows:

1) Heat the aluminum enough to melt 50–50 solder. A blowtorch or a gas range is the best source of heat for large objects. Electric irons rated as high as 200 or 300 watts will not work unless the object to be soldered to is extremely small.

2) Melt a little solder on the part to be tinned.

3) Remove the piece from the flame and scratch the solder into the aluminum with a wire brush; reheat if necessary to keep solder molten.

4) Allow complete cooling before the actual soldering operation is started.

Aluminum is ordinarily hard to solder to because it oxidizes rapidly. However, by brushing molten solder into hot aluminum, the oxide is actually removed and the solder is brought into direct contact with the metal, thus assuring a good electrical and mechanical bond. Once the aluminum is tinned it is very easy to solder.

Obviously, this process cannot be used on delicate parts or hard-to-get-at places. But it is certain that anyone who does much work with aluminum will find the idea useful.

— *Ray Orloski, W9SED*

ABOUT SOLDERING ALUMINUM

It is perfectly possible to solder aluminum. However, aluminum soldering is generally not advisable, particularly on parts exposed to weather, as corrosion will soon set in and the joint will be destroyed. Proof of this can readily be seen by placing an aluminum soldered joint in ordinary tap water for a few days. Corrosion will become quite apparent and in many cases the joint will fall apart. If aluminum cannot be jointed by other satisfactory methods — such as riveting or welding — and soldering must be resorted to, then the joint should be completely covered with a protective paint or lacquer. — *R. W. Woodward, W1VW*

ALUMINUM SOLDER

Anyone who has tried to solder aluminum will appreciate the new "alloy" solder now made available by the L. B. Allen Co., Inc., 9329 Berenice, Schiller Park, Ill. The solder can be obtained in bars, ⅛-inch wire, or flat strips. It will readily join aluminum and common resin-core 50/50 solder will adhere to it easily.

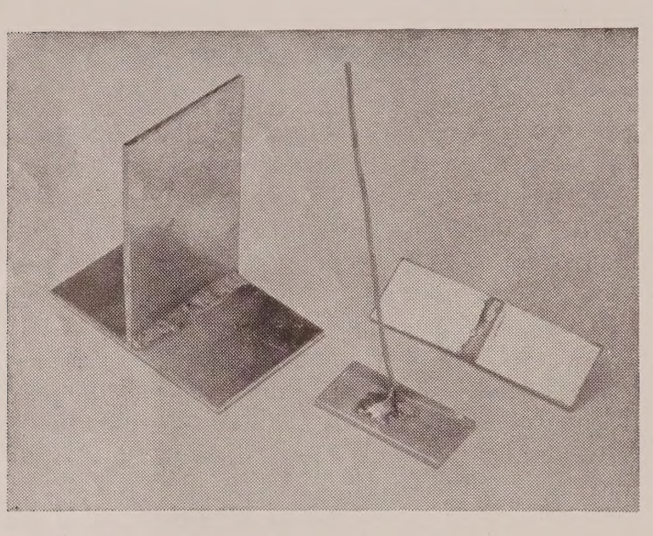


Fig. 1-1—Three typical uses for aluminum solder. The copper wire in the center was joined to the aluminum plate by first wetting the aluminum with the aluminum solder, then soldering with conventional lead solder.

The work to be soldered is first cleaned with a scratch brush or file. The solder is then applied to the aluminum surfaces which are heated by a soldering iron or small torch. When the solder melts, it should be rubbed thoroughly into the surface of the aluminum. This rubbing process tins the aluminum with a rough coat of solder. Once the tinning coat has been applied, the aluminum pieces may be joined by sweating them together.

For those interested, information on the development of this alloy solder for aluminum can be found in the May 1958 issue of *Bell Laboratories Record.* — *B. L. Hinnant, W4RJ*

SOLDERING AND SOLDERING ACCESSORIES

One of the petty annoyances in coil winding with cotton and silk covered wire is frayed insulation. A wire having frayed insulation is difficult to poke through a hole in a coil form, and loose and rumpled insulation certainly does not enhance the appearance of the finished product.

By melting solder directly over the point where the wire is to be cut, sufficient resin will be saturated into the insulation to hold it in place while the cutting, dressing, tinning and soldering operations are performed.

This trick is also very effective when it is necessary to tap a length of insulated wire. The results will not present the appearance of mice having gnawed at the covering!

— *Bill Fishback, W1IKU*

HOMEMADE ELECTRIC SOLDERING TOOL

The soldering tool illustrated in Fig. 1-2 was developed for students at the New York School for the Blind. The iron receives power from a modified broadcast receiver transformer and is controlled by a foot switch. In operation, the iron is held with one hand and manipulated as pliers are handled. Materials to be soldered may be clamped together with the tool, thus leaving one hand free for holding solder. Sections of ¼-inch copper tubing have been successfully soldered with the tool.

The iron is constructed with junk-box and other readily available components. These parts are identified by the letters *A* through *H* in Fig. 1-2. The tips (*A*) are made with carbon obtained from flashlight batteries. The arms or conductors

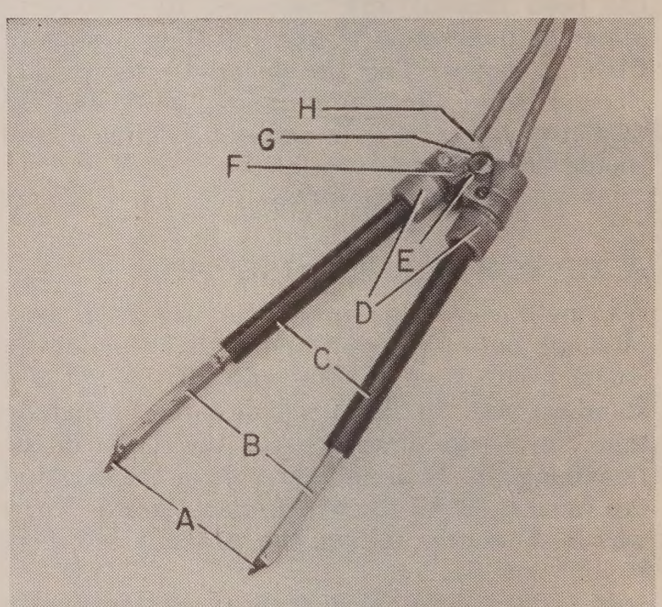


Fig. 1-2—View of the soldering tool described by W2UVF. See text for details of components A through H.

(*B*) are lengths of ¼-inch-square brass or copper rod. Bakelite tubing (*C*) protects the operator's hand against burning and provides electrical insulation between the electrodes. Items *D* are copper-tubing unions. The clamps for the unions (*F*) are made from a piece of brass or copper and are joined together by a pivot assembly (*E*) such as a hinge. The spring return (*G*) spreads the arms or handles when the iron is released. The knurled pieces (*H*) at the top of the iron

(as seen in Fig. 1-2) are union locking nuts that have been finished off with the aid of a lathe.

When constructing the tool, it is first necessary to drill holes in the ¼-inch rods to accommodate the carbon tips. The carbon may then be roughed to size with a hack saw and file. The shank that will be force-fitted into the rod may be conveniently turned down by rotating the carbon in an electric drill and working the material with a file.

The bakelite covering for the rods must extend straight up through the copper unions if electrical insulation is to be provided. The inside diameter of the tubing should fit snugly over the square rods so that the latter will actually be clamped in position when the unions are tightened around the bakelite. Leads made with No. 8 flexible wire should be attached to the top end of each rod. The leads should be long enough to reach down to a foot-operated control switch. Electric-range cable is one good source of flexible lead wire.

The transformer used here at the school is an old b.c. receiver transformer having all of the original secondary windings replaced with a single winding that delivers slightly over 3 volts under load. Because the new winding must carry considerable current, it is made with a conductor consisting of three lengths of ½-inch shield braid connected in parallel. Actual specifications for the secondary will depend on the type of transformer undergoing modification and must be determined experimentally.

The foot control should be a high-current push-type switch, mounted on a slightly elevated board. A 3-inch "T" hinge, arranged to swing over the switch push button, can be used as a convenient foot pedal.

Heat should not be applied to the iron until the units requiring solder have been clamped between the electrodes. Of course, excessive pressure on the electrodes will break the carbon tips. After the solder has been applied, the tool may be used as a clamp while the solder sets.

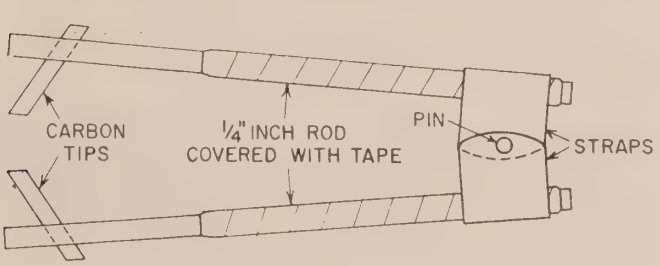


Fig. 1-3—A simplified version of the electric soldering tool

A simpler version of the iron can be readily visualized. One extremely simple model would use ordinary tape for insulation, and a strap-and-pin assembly as shown in Fig. 1-3.

— Harold C. Dressel, W2UVF

SOLDERING TAPS ON SMALL SPACE-WOUND INDUCTORS

It is always a nerve-racking chore to solder taps on small space-wound inductors without soldering adjacent turns together. Since commercial air-wound coils are widely used, the following hint may be of value to many.

The idea is to isolate the selected turn on which the tap is to be attached. This can be done quite effectively by inserting ½-inch wide strips of Reynolds Aluminum Wrap on either side of the tap point. The aluminum foil keeps the solder where you want it, protects the supporting bars by rapid dissipation of heat, and prevents that *messy* appearance that usually goes hand in hand with the operation. The strips can be removed with ease after the solder has hardened.

— Ray Naab, K2YCL

SOLDERING TO SHIELDED WIRE

While soldering TVI-suppression capacitors to the metallic braid of shielded wire, I burned the d.c. insulating coating so badly that it later failed. In replacing the wire, the following step-by-step procedure was employed as a preventive measure against renewed breakdown.

1) Cut the wire to size.

2) Slide the shielding out over one end of the wire for an inch or so.

3) Cut off the protruding shielding.

4) Slide the shielding out an additional ½ inch.

5) Insert a rusted nail or spike (diameter depends on the i.d. of the shielding) into the protruding shielding.

6) Wrap capacitor lead tightly around this end of the shielding, and solder.

7) Slide the shielding back on to the wire and repeat Steps 4, 5 and 6 at the opposite end.

8) Center the shielding, strip d.c. insulation from ends of inner conductor, and solder capacitor leads to wire.

This neat and safe way of soldering to shielded wire may be modified slightly to take care of connections to be terminated at grounded soldering lugs.

— Francis J. Maier, K2BSZ

REVERSING THE HEAT-CONTROL SWITCH OF WELLER SOLDERING GUNS

The newer Weller soldering guns (Type D-550) with dual-heat range have a switch action that is very light. The manufacturer, quite reasonably, points out that high heat should be used only intermittently. Unfortunately, the weight of the gun *vs.* the switch action combines to make it just a little difficult to refrain from pulling the trigger into the second (high-heat) position.

It is relatively simple to remove the case and rewire the switch. There are two terminals on the upper half of the switch and one on the lower part. Reversal of the upper connections will provide high heat on the first position and low heat with the trigger full on.

The change allows the gun to be firmly grasped and the trigger firmly pulled all the way on as the work is begun. Momentary release (partial) of the trigger raises the heat quickly and easily.

— William H. Fishback, W1IKU

MISCELLANEOUS SOLDERING HINTS

THE problem: Field repair of a broken receiving antenna without having access to 115 volts a.c. for a soldering iron.

Solution: After cleaning the ends of the wires and looping them together, the joint was wrapped with solder that had been flattened with a hammer. The solder was then melted with a small torch, in this case an ordinary match!

Not the most highly recommended method of making an electrical joint, but certainly one worth remembering when an emergency arises.

— *Robert Carpenter*

—···—

ONE simple method of preventing damage to a polystyrene coil form during soldering is to insert the form in an inexpensive wafer socket before applying heat from the iron. The socket does carry off some of the heat that would otherwise reach the prongs, but it makes up for this by maintaining the prongs in perfect alignment.

Here at WØSGG, we mount the socket in a sheet of material that can be clamped in the bench vise, thus taking care of the problem of holding the coil form while working on it.

— *Otto Woolley, WØSGG*

—···—

HERE is another method of protecting polystyrene coil forms against heat.

When ready to solder, stand the form on its end with the prongs sticking up. Wrap a piece of half-inch masking tape around the form with its uppermost edge protruding up over the prong end by approximately 3/16 inch. Using a teaspoon, fill the walled-in area around the prongs with water.

You can now apply heat and solder to the prongs without too much danger of the form melting and the prongs becoming misaligned.

— *Alexander McGlashan, K2GIN*

—···—

A TINNED copper wire extension added to the regular tip of a gun type iron will facilitate soldering in some seemingly inaccessible places.

Clean and tin the wire extension and then bend

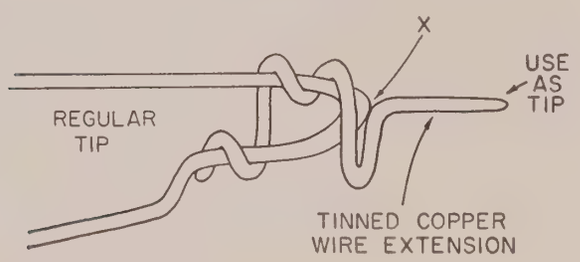


Fig. 1-4—Sketch showing how W5CYF extends the usefulness of a soldering gun by extending the length of the tip.

it tightly around the main tip as shown in Fig. 1-4. Make very sure that the tips are clean and in good contact at point marked X, and add a little solder at this junction to assure maximum transfer of heat.

The extension may now be bent into a shape best suited for the job. Of course, the wire will not transfer enough heat for heavy soldering operations, but it does permit doing many light jobs located in hard-to-get-at spots.

— *Edwin B. Robertson, W5CYF*

—···—

A HANDY *unsoldering* accessory is a tool made from an old hacksaw blade. The surplus scavenger will find it practically indispensable and, if he has a power grinder available, it can be made in a few minutes.

The shape of the *unsoldering aid* is shown in Fig. 1-5. Remove the teeth from the blade while the grinder is turning over and, of course, make the tool long enough to permit a good grip. Adhesive tape of one type or another may be

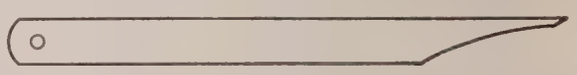


Fig. 1-5—An illustration of the unsoldering aid suggested by W7JJP. The tool is made from a hacksaw blade.

used to cover the handle part, but do not cover up the hole at the grip end. Just remember to use that hole to good advantage — slip it over a nail driven high in the wall — if you have any junior ops that can creep into the workshop!

— *Rudy Erickson, W7JJP*

—···—

WHEN removing the base from a plug-in coil, tube, or multiwire connector, it is always helpful if the prongs involved can all be unsoldered at the same time. Use of a homemade ring tip such as illustrated in Fig. 1-6 will allow all prongs to be heated simultaneously.

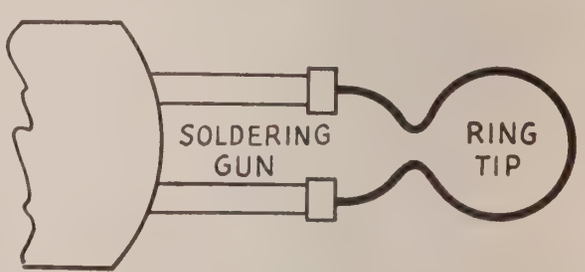


Fig. 1-6—Illustration of the ring tip used by W1MWO for simultaneously unsoldering a number of base prongs.

The ring tip is made with tinned No.12 or 14 copper wire. The loop should be just large enough in diameter to encircle the ring of prongs that require heat, and the leads to the soldering gun should be as short as possible.

This method can also be used to unsolder canned components by forming the tip properly.

— *Harry Star, W1MWO*

—···—

THE accompanying photograph, Fig. 1-7, is an open-for-inspection view of a soldering aid that has seen factory use for the past four years. The aid has so speeded soldering operations that we simply *litter* the bench with them so that whenever we reach for solder — it's there.

The aid consists of small diameter solder wound on the film spool of a 35-mm. film cassette. Up to

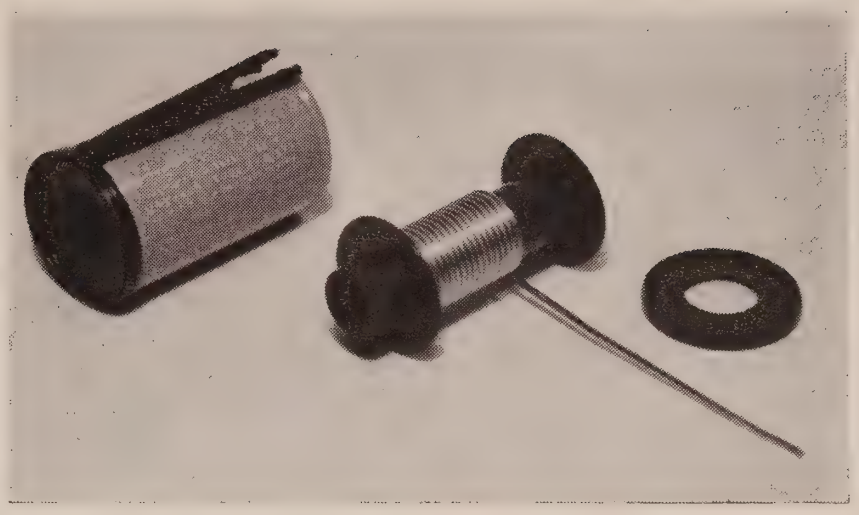


Fig. 1-7—An open-for-inspection view of the soldering aid made from a 35-mm. film cassette. WØOJS gives construction details in the text.

four layers of solder may be wound if a 36-exposure cassette is used. When reassembling the unit, make certain that the solder feeds through the velvet lined slot properly by aligning the slot with the solder lead. Otherwise the solder will not release easily. A small hole is drilled in the spool to hold the starting end for ease of winding.

Cassettes may be obtained from some film processing companies at no cost because they are not normally reused after the film is developed.

Incidentally, Kester Company puts out an excellent booklet on the subject of soldering. A copy makes good reading for anyone interested in the proper application of solder.

— *James R. Grace, WØOJS*

CUTTING COIL STOCK

THE USE of a small saw to cut Miniductor or Air-Dux is not very satisfactory because a considerable length of the coil is damaged. A hot razor blade may be used to cut even the smallest coils with no damage to adjacent turns. A single-edged blade is clamped in a bench vise. Paper or tape should be used to reduce heat loss to the vise. The tip of a soldering gun or iron is applied to the side of the razor blade while one of the plastic rods of the coil is pressed gently against the cutting edge. After cutting all of the support bars, the two parts of the coil can be separated far enough to cut the wire with diagonal pliers.

— *E. P. Smith, W8JYY*

—···—

THE difficult task of cutting fine pitch Miniductors can be easily accomplished by breaking a discarded razor blade in half and fastening

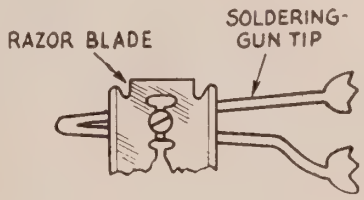


Fig. 1-8

one half of the blade to the tip of a soldering gun as shown in Fig. 1-8. Slip the blade between the turns to be cut and switch on the soldering gun. As the blade warms up it will cut through the plastic. Don't allow the tip to remain hot too long as this will melt the plastic and loosen adjacent coil turns. Incidentally, for safety's sake, hold the razor blade in a vise and break it with pliers.

— *E. A. Sahm, W5FFE*

—···—

CLOSE-SPACED commercial coil stock can be cut without damaging adjacent turns by simply using a length of fine wire, a soldering iron, and a pair of long-nose pliers.

The wire used should be smaller in diameter than the spacing between turns. Loop it around a support bar as shown in Fig. 1-9 and then twist

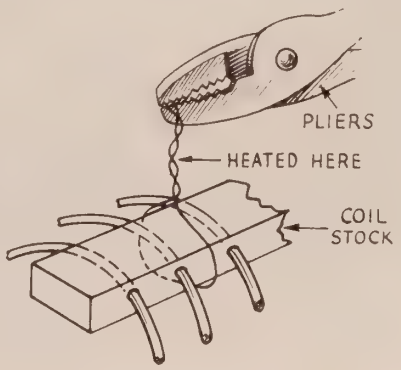


Fig. 1-9—Sketch of W7WFC's "hot wire" method of cutting coil stock. Heat from a soldering iron is applied to the pigtail as indicated.

the ends into a pigtail. Grasp the free end with a pair of long-nose pliers and apply heat from a soldering gun at the point indicated. Pull the heated wire through the melted support bar, and then repeat the operation on the other three supports. Clip the two sections apart with a pair of cutters and the job is finished without strain.

— *Dale E. Miller, W7WFC*

TAPPING HOMEMADE COILS

ONE neat and simple method of providing taps on hand-wound coils is to form, wherever a tap is necessary, a small tightly coupled loop in the wire. After the loop has been cleaned and tinned, the winding may be continued.

— *Harold Morris, W4VUO*

TAPPING CLOSE-WOUND COILS

PUTTING a tap on a Miniductor coil whose turns are spaced rather closely together can pose somewhat of a problem. For example, a No. 20 wire will not pass between the turns of a coil of No. 24 wire wound 32 turns per inch. A solution is to flatten the end of the wire used for making the tap. This can be done by putting the wire on a hard flat surface and pounding it flat with a hammer. The wire can easily be flattened to a thickness of a few thousandths of an inch so that it can be wrapped around a coil without shorting adjacent turns. The wire can be annealed to its original pliability by momentarily heating it red hot over a flame and allowing it to cool slowly. After cleaning the wire with steel wool it can be soldered in place easily; small strips of aluminum foil alongside the tap will keep the solder from running to adjacent turns.

— Leo B. Weiner, W3LOS

MOUNTING AND TAPPING B & W MINIDUCTORS

NEARLY all users of B & W Miniductors mount these small ready-wound coils out in the open without regard to mechanical protection. In cases where the latter is desirable, it is suggested that the inductors be slipped inside of regular coil forms. The Amphenol types 24-4P, -5P and -6P will accommodate the 1-inch diameter coils and several manufacturers make forms that will enclose the ½- through ¾-inch diameter units. In most cases, it is necessary to round off the outside surfaces of the coil support bars (use fine sandpaper) before the Miniductor can be slipped into the form.

Another method of mounting Miniductor is shown in Fig. 1-10. The protective covering for the coil is a transparent case used originally by a

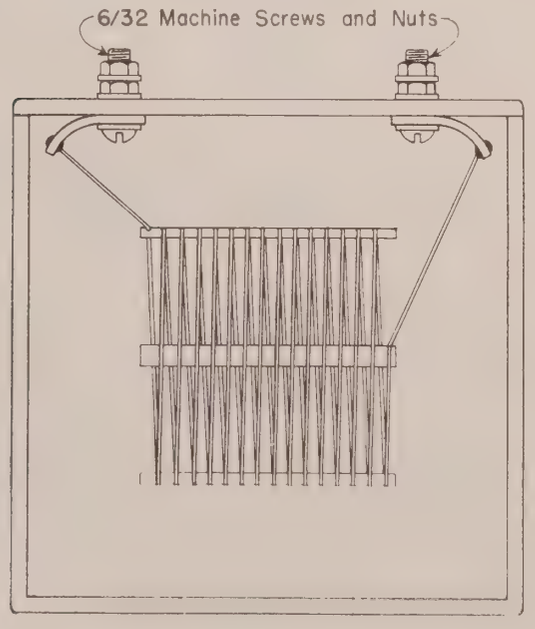


Fig. 1-10—B & W Miniductor mounted in a transparent parts container.

manufacturer (Walsco) as a container for hardware and small radio parts. This method of support is especially effective and convenient because it permits chassis or panel mounting, provides good mechanical protection and prevents the accumulation of dust around the turns, support bars, etc.

Taps easily can be soldered to Miniductor by using small wire — No. 36 does very well — and

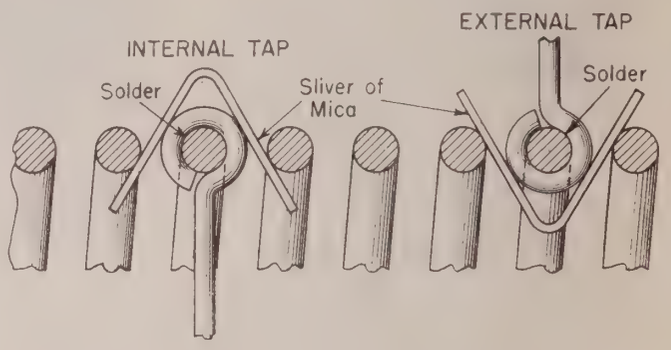


Fig. 1-11—CP1BK suggests the use of small wire and a mica sliver when soldering taps to B & W Miniductor.

a sliver of mica. Fig. 1-11 shows how the mica can be used to protect the winding during the soldering operation and to prevent shorts between the tapped and adjacent turns. *— CP1BK*

COIL SHIELDING HINTS

THE aluminum containers used for packing 20- and 36-exposure 35-mm. film make excellent shields for miniature plug-in coils. The hump in the screw cap can be pressed flat with any blunt instrument. Attach this cap to the chassis along with the coil socket. The aluminum cover may then be screwed in place over the coil making a solid installation, both electrically and mechanically. The appearance of the assembly leaves nothing to be desired.

If you are not lucky enough to have a spare packing can or two on hand, you may be able to secure a small supply from a local film concern.

— Stanley P. Guth, W7KGF

—···—

SOME of the more expensive cigars come in aluminum humidors which, when cut down to size, make fine shields for small slug-tuned inductors. The removable cap for the case is drilled or punched at the center so that it may be fastened to the chassis along with the coil. A hole should be placed in the top of the shield so that the coil may be tuned after the shield is mounted in place.

— Ernest A. Coons, W1JLN

HANDY COIL WINDER

THE inner cardboard tube from bathroom tissue rolls makes a snug fit over the top of a 45 r.p.m. record player spindle and thus makes a handy method for winding coils. The speed is a convenient one and will make short job of the winding.

Multilayer or scramble-wound coils with a large number of turns may be counted approximately by using the second hand of a watch after calculating the number of turns per second. If the wire is large enough in diameter to stand the

strain, tension pay be put on the wire to slow down the motor for slower and tighter winding.

— L. E. Copleston

MAKING SLUG-TUNED COILS FROM COAX

TUNABLE coil forms for v.h.f. and u.h.f. converters or transmitters can be made from scrap pieces of coax cable, such as RG8/U or RG87/AU. The outside shield and inner conductor are removed and the end product is a polyethylene or teflon tube with an o.d. of 0.3 inches and an i.d. just large enough for a 6-32 tap. The plastic tube can be cut with a tube cutter or a small hack saw to any convenient length. The 6-32 thread is tapped clear through; this allows you to fasten one end to the chassis with a short screw and a star washer to prevent turning. The brass screw

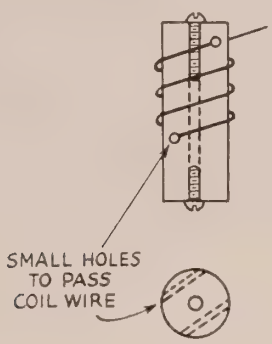


Fig. 1-12—Sketch showing the slug tuned coil made from a piece of coax.

changes the inductance enough to shift the frequency a few megacycles. The wall thickness is about 0.1 inches which allows a small hole to be drilled between the outside wall and the center. Choose a drill to obtain a snug fit for the wire being used.

— James Theodore, W7LJA

MAKING FARADAY SHIELDS

THE construction of Faraday shields can be simplified by using materials included in etched-circuit kits. The desired shield is drawn on a piece of copperclad phenolic using the special etch-resistant ink. Etching solution is then used to remove the unprotected copper, leaving the shield ready for easy mounting.

Incidentally, most mail-order houses list the kits under the *printed circuit* heading of their catalogues.

— E. Laird Campbell, W1CUT

COIL WINDING HINT

THE spacing between turns of homemade solenoid-type inductors can frequently be controlled by using ordinary sewing thread as a spacer. Naturally, the diameter of the thread should be equal to the desired spacing between turns. Usually, thread suitable for the purpose can be found either in the XYL's sewing cabinet or at the local dime store.

When employing this old construction hint, first coat the coil form with a thin layer of coil dope. Allow the dope to dry until "tacky" and then wind the required turns of wire. Space the turns with a winding of thread. Carefully remove the layer of thread after the dope is completely dry.

The inductor may then be covered with a light coating of dope. Avoid using an excessive amount of dope because a heavy, slow-drying application may cause the turns of wire to slip out of position.

— J. Herm Rickerman II, K2HXP

VOLTAGE CHANGE NOMOGRAPH FOR ELECTROMAGNET COILS

THOSE who like to rewind d.c. relays, solenoids, transformers, motors, or generators to operate on a new voltage and current will find the nomograph in Fig. 1-13 a time saver.

The first three columns are for dividing the present operating voltage by the desired voltage. The right-hand three columns are for multiplying the cross-sectional area of the present wire by the voltage ratio to give cross-sectional area of the desired wire. By choice, the scales on the wire columns are given in AWG gauge and inches diameter rather than in cross-sectional area.

Example:

On hand —

24-volt relay wound with No. 26 wire.

Problem —

To find wire size to rewind relay for 12 volts.

Procedure —

1) Under present volts, mark 24 volts.

2) Under desired volts, mark 12 volts.

3) Draw line through 24 and 12 volts to ratio column.

4) Under present wire, mark No. 26 wire.

5) Draw line through ratio and No. 26 wire to desired wire column. Read No. 23 AWG gauge, or .023-inch diameter wire.

With this change in wire and voltage we get: one half the voltage, twice the current, one fourth the resistance, two times the cross-section area of wire and one half the turns (assuming same winding space filled).

— Guy Buckner, W5VGK

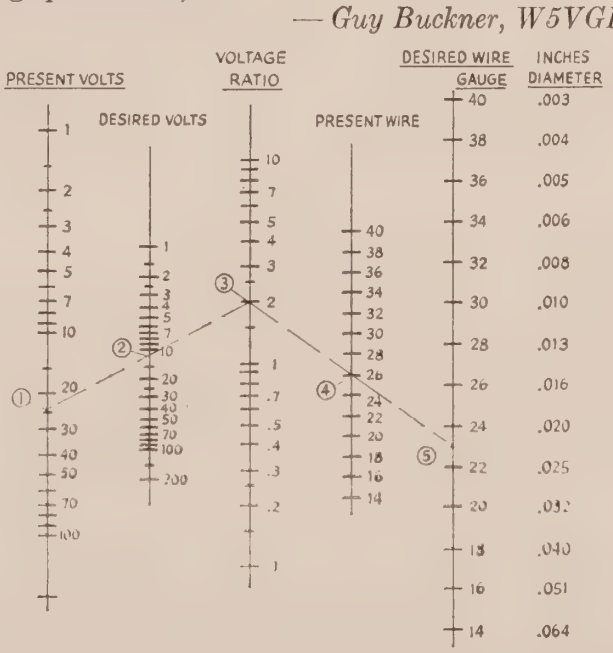


Fig. 1-13—Voltage Change nomograph for electromagnetic coils.

ALUMINUM FOIL TEMPLATES

CHOKES, transformers, etc. — especially surplus brands — are frequently housed in complicated castings with mounting holes at the bottom that seem to have been laid out any-old-how. This type of construction usually presents a problem when the time comes for laying out the chassis.

One solution is to take a sheet of aluminum foil such as Reynolds Wrap and lay it flat over the mounting surface of the component. Gentle rubbing with a fingertip will then bring out the position of the mounting holes as well as the outline of the casting. The template may then be trimmed down to size with a razor blade, transferred to the chassis, and the mounting hole locations spotted with a scribe or center punch.

Credit for this technique goes to the small boy observed "making money" by rubbing a tinfoil wrapper placed on a fifty-cent piece.

— *John Paddon, VE3VC*

ANOTHER USE FOR ALUMINUM FOIL

HERE is an idea which I found in the September, 1955, issue of the *P. F. Reporter.*

When doing touch-up painting or some similar small job, press some aluminum foil (such as Reynolds Wrap) into a cup or container and paint from this. When finished, the excess paint can be poured back, and the foil thrown away, leaving a clean container and much less mess. It also works when cleaning brushes.

— *R. L. Ellis, W5YVQ*

USING "SARAN WRAP" IN THE SHACK

A SIMPLE, inexpensive and effective protective cover for ARRL certificates, FCC licenses, QSL cards, etc., can be made with Saran Wrap. Cut a section of this transparent plastic food wrapper to a size slightly larger than the area to be covered or protected. Then take a piece of cardboard and cut it exactly the same size as the certificate, license, card or what have you. Now, sandwich the item to be protected in between the Saran Wrap and the cardboard backing. Fold the transparent wrapper over at the edges and then use Scotch Tape to bind the loose ends to the cardboard backing.

— *Charlie Tiemeyer, W3RMD*

REMOVING PAINT FROM PANELS

ACETONE is useful in removing paint from a panel and chassis when a tight metal-to-metal r.f. seal is needed. Use only enough acetone to remove the paint in the desired area. Several applications of small "doses" on the selected area seem to work better than a single soaking on the entire panel.

Acetone is flammable so safety precautions should be observed during the entire cleaning process. Also, avoid breathing the fumes from the acetone and do the cleaning in a well-ventilated area.

— *Nelson Bigelow, jr., W5HQL*

ALUMINUM WORKING HINT

RUBBER FEET for chair legs, which can be purchased cheaply at any variety store, are very handy in working aluminum.

When fitted over a hammer head, as illustrated in Fig. 1-14, the foot enables aluminum to be bent and shaped without scarring or ruining the

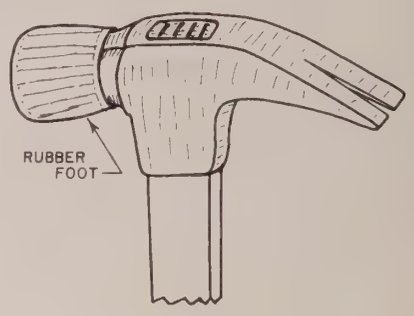


Fig. 1-14—W5YVQ slips a "rubber foot" over the head of the hammer when the tool is used for forming aluminum.

finish. The small initial cost will be repaid many times over in neater work.

These rubber feet also make a handy hot tube puller, and they are flexible enough to be used for several sizes of tubes.

— *R. L. Ellis, W5YVQ*

CLEAR PLASTIC REFINISHING

RESTORATION of transparency and lustre to scratched or fogged clear plastics is easily done by going over the surface of the plastic with fine grade steel wool. Use fast light strokes until the entire surface is matted. Don't concentrate on individual scratches; bring the entire surface down to the level of the deepest scratch. After the surface is leveled and evenly matted, apply ordinary household silver polish cream and rub lightly with the finger tips or with a piece of fine chamois. A few minutes of light rubbing will make the plastic as clear as glass.

— *John B. Ferguson, jr., W3AEV*

GRAPHITE AS A LUBRICANT

POWDERED graphite, obtainable in tube form from most auto stores, makes an ideal lubricant for panel bearings, rolling contacts of rotary inductors, and other control mechanisms that become squeaky or binding after a period of use. Graphite is also a good conductor and therefore will not adversely affect the operation of a circuit if, during application of the lubricant, it is allowed to make direct contact with capacitors, coils, etc.

— *Wm. C. Martin, W6PLK*

LUCITE REPLACEMENT FOR WINDOW GLASS

A SHEET of ⅛-inch lucite, cut to size and used as the replacement for a cellar windowpane, provides an easily worked surface for mounting feed-line feed-through insulators, etc. Mount the lucite in place with regular glazier's tacks and putty. Save the window glass for the day when it becomes desirable to return it to the frame.

— *E. M. Fry, K2CW*

UTILIZING BURNT-OUT METAL TUBES AS CABLE PLUGS

EXCELLENT cable connectors can be made from tubes such as the 6H6, 6C5, etc. First, pry the metal shell loose from the base of the tube. Then remove the glass and metal components from the shell and unsolder the leads which connect to the base prongs. Drill a hole for a rubber grommet at the end of the shell and slip the grommet in place. After the cable has been passed through the grommet and the ends soldered to the base prongs, place the shell back on the base and crimp it securely in place with pliers or other suitable tool.

— Peter Baghdasarian, W1YHU

COLOR-CODE REMINDER

MANY of the sentences used for remembering the resistor color code are not exactly printable. However, *Radio ZS* for March, 1954, carried one that is worthy of being repeated for the benefit of anyone who finds only occasional use for the color code. The sentence, "Better Be Right Or Your Great Big Venture Goes West," supplies in correct order the necessary reminders for Black = 0, Brown = 1, Red = 2, etc.

— Perry F. Williams, W1UED

USING RUBBER GROMMETS AS RUBBER FEET

AN easily installed substitute for bumper feet is a set of rubber grommets mounted in the usual manner where the feet are desired. This idea works well on metal cabinets, chassis bottom covers, etc. Frequently, the grommets will give more "slip-proofing" than standard rubber feet!

— Merritt F. Malvern, W2ORG

ANOTHER USE FOR THE MOTHBALL

THE silver-plated contacts of components — switches, relays, etc. — headed for a rest in the junk box may be protected against tarnish by dropping one little mothball into the storage compartment. You will appreciate how well this stunt works when you next solder to the terminals of a component so protected.

— Neil Johnson, W2OLU

EASIER REMOVAL OF BATTERIES FROM HOLDERS

PENLIGHT cells in test instruments or transistor devices are sometimes difficult to remove from the battery holder for replacement. The designer's success in tucking the batteries into a recess, or out-of-the-way corner, is least appreciated at that moment.

Before slipping a replacement battery into place, wrap a strip of plastic electrical tape around it near one end (to clear the clip in the holder). Bring the ends of the tape together to form a projecting tab about a half-inch long. This tab is easily grasped with pliers or fingers, the next time the battery needs removal.

— Edmund B. Thompson, KØLLJ

PLASTIC STORAGE BINS

THE small plastic boxes such as the ones in which General Cement Company packages small hardware and parts sometimes become a problem when scattered around the workbench. These can be cemented together side by side in units of six and then they become handy permanent storage units. Use a plastic solvent such as ethylene dichloride for cementing. If the boxes are narrower at the bottom than at the top a thin plastic skin can be cemented along the bottom edge.

Ethylene dichloride is an excellent solvent for cementing all types of plastic, even where acetone will not work.

— Don Maxwell, W8FQS

STORAGE RACK FOR SPOOL-WOUND WIRE

THE round slender type of curtain rod that is available from most dime stores and hardware concerns makes an ideal rack for spools of wire. One or more of the rods may be easily mounted on the workshop wall, under a table or bench, or on the inside of a closet door.

— Thomas Skopal, W3WJN

WIRING ASSIST

WHEN doing construction work, make a sketch of the original schematic diagram and run a red pencil over the lines of the circuit as each part and wire is put in place. This will help to prevent wiring mistakes and will simplify the wiring of a complicated circuit. Furthermore, it tells at a glance what wiring has been done and what wiring has yet to be done.

— R. L. Ellis, W5YVQ

MODIFYING UNDERSIZE SURPLUS PHONE JACKS

UNFORTUNATELY, many of the inexpensive surplus phone jacks have too small a bore to accommodate a standard size phone plug. An easy way to convert these cheap but undersize jacks into useful equipment is to mount them firmly in an old chassis and then redrill the bore with a ¼-inch drill. After this simple operation, behold, a standard jack!

— Rev. Michael Windolph, W9NEL

PREVENTING WEAR ON PANEL FINISHES

AFTER several months of operating some new equipment, I noticed a shiny circle appearing on the panel behind a frequently-used control. Unwittingly, I had allowed my finger to drag on the panel as I operated the control and had worn the paint surrounding the knob.

My remedy was to drill a hole in a thin piece of clear plastic and slip it onto the panel behind the control. The plastic protects the paint but allows the lettering around the knob to be seen. It's a good idea to apply this scheme to all controls and switches that are used repeatedly.

— Ronald Phoenix, W9HFN

GROUNDING SHIELDED LEADS

A NEAT and effective method of anchoring and grounding shielded leads at through-chassis points is shown in Fig. 1-15. Section A of the drawing shows how a shakeproof washer is drilled

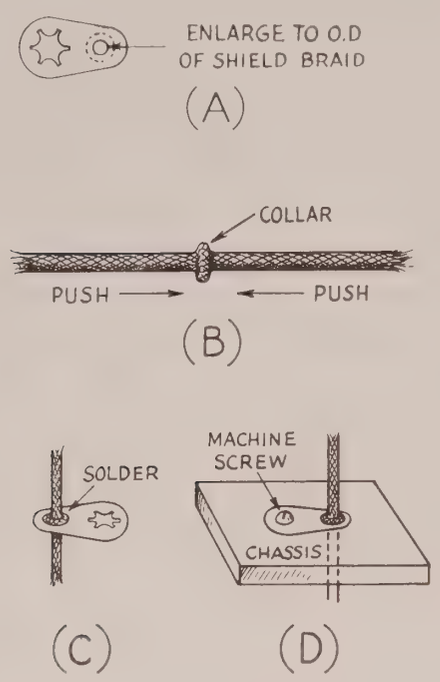


Fig. 1-15—Illustration of the method of grounding shielded wire at through-chassis points.

or reamed to fit around the shield braid. The braid is fitted with a small collar as indicated in B, and is then slipped into the lug and soldered as shown in C. The wire is then pushed through a chassis hole of appropriate size, and the lug is bolted down with a machine screw and nut as illustrated in section D of the sketch.

If the wire is to be unshielded after it enters the chassis, simply clip the braid at the point of entry and solder it to the top side of the lug.

— *Herbert Wade*

FLEXIBLE SHIELDING FOR CABLES AND JOINTS

CUSTOMARY methods of shielding fall short of the requirement when a shielded cable or lead has to be tapped. The following idea permits a tap or joint to be effectively shielded even when it is desirable to maintain flexibility of the conductor.

First, cover the area where the wire is exposed with thin electrical tape such as Scotch Tape No. 33. Next, cut some paper thin brass or copper sheet into ½-inch strips of convenient length. Now, "tape" the joint with the metal strip, overlapping the regular shield braid ¼ inch or so at each end of the wrap. Lightly and quickly solder the metal wrapping to the braid at each end and you have a flexible shielded joint.

— *George F. Reynolds, VE4AG*

PREVENTING R.F. LEAKS WITH ALUMINUM FOIL

ORDINARY aluminum foil — the kind that the XYL uses around the kitchen — can be used to seal up cracks or holes that must be covered in the interest of good shielding. Merely cut the foil into ½-inch strips of proper length and seal it over the openings with 1-inch masking tape. It works! — *George E. Forant, W1FON*

CHEAP AND EASY SHIELDING OF POWER CABLES

PLATE, filament, power mains and relay control leads are expensive and difficult to shield by conventional methods. However, such shielding can often result in a substantial reduction of TVI. The idea is to slice an 18-inch roll of heavy duty aluminum foil into 2-inch-wide rolls with a single-edge razor blade. Then spiral wrap the power cables with a 1-inch overlap to provide good contact. The ends can be fastened tightly with metal cable clamps to which the grounding system is connected. This method easily accommodates wires fanned out of the cable. Lacing or spot tieing of the cable before shielding helps to make it a neat job.

It should be noted that it is essential to use heavy duty aluminum wrap because the lighter foil tears easily.

— *Jack Blindbury, W6VIO*

USING REYNOLDS "DO-IT-YOURSELF" ALUMINUM FOR SHIELDING

THE Reynolds do-it-yourself aluminum products are now available from many hardware stores. Most of the items are relatively inexpensive and some of them are ideally suited to ham-type shielding projects. Nice thing about shopping for the metal is that it is stored in "open-for-inspection" display racks — right where you can examine each piece or shape for its adaptability to a particular job. Here are three suggestions on how to use the material for shielding transmitters. — *Ed.*

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ONE form of extruded aluminum comes in five- and six-foot lengths. It is designed for those hardy souls who wish to construct their own storm sash. The strips have a groove nearly ¼-inch deep which is intended for holding glass in place. Strips of this metal can be used for holding flat shielding plates at such places as the rear of a cabinet, the top of a box, etc.

This type of strip may be fastened to three sides of an opening. A sheet of aluminum large enough to cover the opening is then inserted, slide-door fashion, into the grooves. METEX TVI-20-S electronic weatherstripping (see page 89, *QST*, September, 1953) can be sewed on the inside of the door (the side facing in toward the cabinet) at the unclamped end to prevent r.f. leakage. If the aluminum sheet is too thin to fit snugly inside the grooves, it is advisable to weatherstrip along all four sides of the door. Handles can be bolted in place to facilitate easy removal, and holes may be punched wherever ventilation is necessary.

— *H. L. Kreh, W8TCH*

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THE ¾-inch aluminum angle manufactured by Reynolds may be used as corner posts for

shielded chassis enclosures. But what must throw many fellows is the problem of making neat corners without special tools and with all surfaces flush.

A solution to this problem is shown in Fig. 1-16. It is believed to be the simplest possible. Note

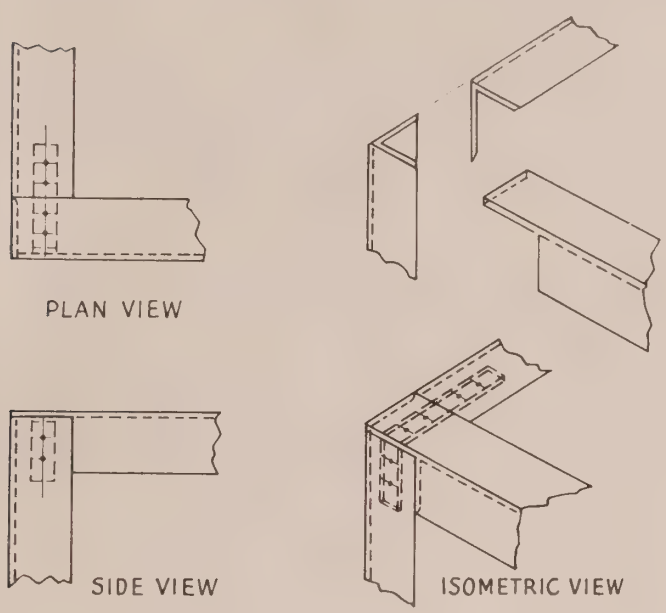

Fig. 1-16—Sketches of the corner post described by W2HCP.

that only one cut is necessary other than a square end and that is just to cut away ¾ inch of the vertical flange of the front-to-back member. A simple right angle strap underneath and suitable machine- or self-tapping screws complete the three-way joint.

— F. Landsperger and Wendell P. Munro, W2HCP

REYNOLDS also offers an assortment of 36 × 36-inch sheets to work with. Plain, patterned and perforated aluminum is available in this size. Although the material is quite thin, it is rugged enough for use as the flat surface of many shielded enclosures. The perforated stock is the most expensive, selling at a local hardware store for $2.98 per sheet. Plain aluminum sheets are $2.49 at the same store. *— Ed.*

CHASSIS-LAYOUT AID

THE construction practices chapter of recent editions of *The Radio Amateur's Handbook* makes the excellent suggestion that one commence construction by covering the chassis with a sheet of paper. The location of components, mounting holes, etc., is then marked on the paper so that the latter may be used as a drilling template for components to be mounted above deck. After drilling, the parts which require mounting underneath may be located and the mounting holes drilled, making sure by trial that no interference exists with parts mounted on top.

An easy way to *ensure* a good alignment of components below with those above the chassis is to place a sheet of *translucent* paper (onionskin) on top of the chassis, and mark on its top surface the position of topside parts. Then place the same sheet against the underside of the chassis, unmarked side exposed, and locate the parts to be mounted inside the chassis. Since the paper is translucent, these may be easily placed so as not to interfere with components on top of the chassis.

— David Weinfeld

PROTECTING CHASSIS FINISH DURING CONSTRUCTION

AN application of wax to a new chassis, especially plated ones, will prevent finger marks during construction. After the work is finished, pencil or crayon marks used during layout can be removed by applying more wax. Paraffin or candle wax, rubbed into a cloth moistened with benzine, naphtha or lacquer thinner provides a good protective coating and dries almost immediately.

— Joseph J. Kosina, W2LGK

[EDITOR'S NOTE: A coating of clear plastic spray may also be used to protect the finish of a chassis during construction. The protective layer peels off most easily after marking, drilling, etc., have been completed.]

REMOVING PILOT LAMPS

AN ordinary wedge-type pencil eraser, obtainable from most any 5- and 10-cent store, makes an ideal tool for removing pilot lamps which are located in hard-to-get-at places. Use the wedge end of the eraser as the handle, slip the open end (the end which normally fits over the pencil) over the lamp, and twist. It almost seems as though the eraser was designed for the bulb-removing assignment. *— Dane Terrill, W8MQS*

REPAIRING CERAMIC OR ISOLANTITE COMPONENTS

A BROKEN ceramic or isolantite component (insulator, capacitor support bar, etc.) can be quickly and effectively repaired by using Plastic Tile Cement to secure the break. The cement is sold by many hardware stores for approximately 35 cents per can. This manner of repair is not recommended for parts that will be subjected to great stress. *— Sy Greenberg, W2IHE*

STARTING HARD-TO-GET-AT MACHINE SCREWS AND NUTS

WHEN the needle-nosed pliers are too cumbersome, and the fingers are too clumsy, try starting a machine nut as follows:

Press the eraser of an ordinary pencil momentarily against the barrel of a hot soldering iron. Stick the nut to the melted eraser and then use the pencil to poke the nut in place; a screwdriver will do the rest. *— Frank Joseph, W9AOI*

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WHENEVER difficulty is encountered in getting screws, washers and nuts into tight corners, it is possible to solve the problem by wrapping a couple of turns of masking tape, sticky side out, around the end of a pencil. Any small piece of hardware will stick to the tape long enough to allow completing the job on hand.

— Joseph J. Kosina, W2LGK

RESTORING BLACK CRACKLE FINISHES

BLACK crackle finishes can be restored to their original factory appearance by first washing with a mild soap and warm water. Apply a light coating of liquid furniture polish; let dry for a few minutes and then wipe off with a clean, soft cloth. The old panel will look as good as new. The same cleaning process works well on bakelite meter cases and knobs.

— *Sol Davis, W3WPN*

READING FADED TUBE TYPE NUMBERS

THIS is far from being a new idea but is presented for the benefit of the newcomers. The number stamped on the glass of old tubes is sometimes almost impossible to read. Wipe the tube clean with a soft cloth, then breathe on it as you would to clean a pair of glasses. The condensation of the moisture from the breath on the cold glass of the tube should make the number stand out plainly.

— *John McMullen, WØVJS*

ILLUMINATING METERS

A SIMPLE and effective method of providing illumination for most of the standard panel meters is to cut a small slot in the top of the meter case, as shown in Fig. 1-17, and mount a

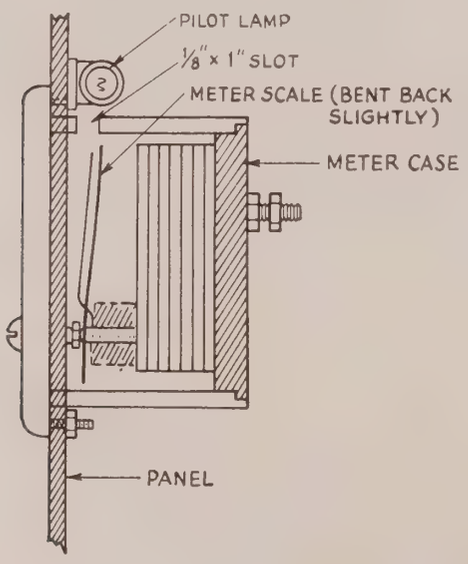


Fig. 1-17—Cross section of the meter showing special illumination slot.

pilot lamp directly above the slot. The meter scale will have to be bent back slightly and the slot covered with transparent cellophane or plastic material to keep dust out of the instrument.

— *William Vandermay, W7DET*

REMOVING STATIC ELECTRICITY FROM PLASTIC METER COVERS

A STATIC charge, as noted on plastic meter covers of various test instruments and meters, can in most cases be greatly reduced or eliminated by cleaning the plastic meter face with a liquid detergent. Use the detergent full strength, wipe it on and off the face of the meter with a clean soft cloth

— *Stuart Leland*

HANDY MOUNTING FOR THE NEON BULB

A SMALL neon bulb may be protected against breakage by mounting it inside a plastic dental floss container (Johnson and Johnson "New Era," pocket size) as shown in Fig. 1-18.

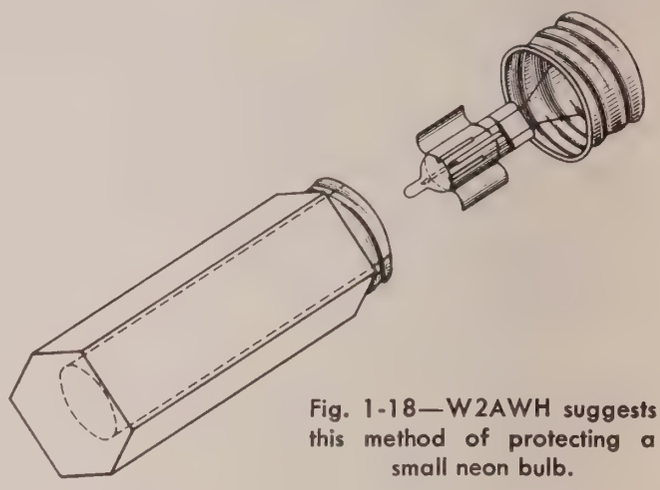


Fig. 1-18—W2AWH suggests this method of protecting a small neon bulb.

The hexagonal cross section of the case reduces the possibility of the assembly rolling off a table or bench and the length of the insulated container makes it safer to probe high-voltage circuits.

Three or four radial fins of Scotch Tape, fastened to the neon bulb, are used to center the bulb in the container. The pigtail leads for the bulb should be soldered to the inside of the metal cap of the case. The bulb, with its fins attached, is forced into the container, and the cap is screwed on.

— *Yardley Beers, W2AWH*

A HANDY CONTROL-TERMINAL PANEL

THE PANEL shown in Fig. 1-19 may be used for mounting control switches, antenna feed-line terminals, coaxial receptacles and other items. Terminals and jacks located at hard-to-get-at spots at the rear of a receiver or other pieces of equipment may be piped out to the new panel so that the connecting and disconnecting

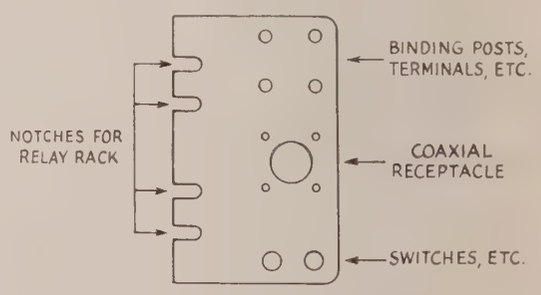


Fig. 1-19—The auxiliary panel used by W3GKP for mounting feed-line terminals, jacks, control switches, speaker terminals, etc.

of leads and cables can be done with a minimum of effort.

The panel may be made with aluminum, bakelite, Presdwood, etc. It should be notched as shown if it is to be mounted on a relay rack or a rack-type receiver panel. The size, layout and drilling should accommodate individual requirements. Provision for extra jacks and terminals may come in handy at a later date.

— *William L. Smith, W3GKP*

CONTROL SHAFT FOR SURPLUS-TYPE APC CAPACITORS

MOST of the surplus APC type variable capacitors have short shafts intended for screwdriver adjustment. Fig. 1-20 shows how a small homemade aluminum bracket and a panel-

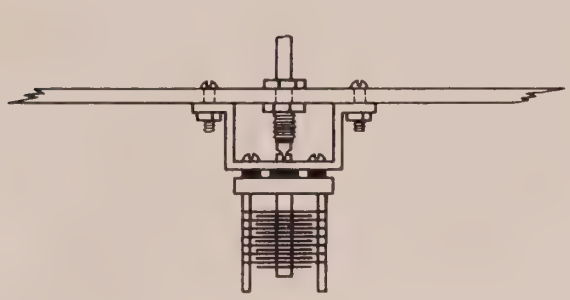


Fig. 1-20—Drawing of the bracket-bearing assembly that permits knob control of short-shaft variable capacitors.

bearing assembly can be combined to permit using a knob with these capacitors.

The panel-bearing assembly may be a standard manufactured component or it may be a makeshift affair obtained by salvaging parts from an old potentiometer or rheostat. The section of the shaft that protrudes from the rear of the panel bushing must be filed flat to mate with the slot in the shaft of the capacitor.

— *Herman W. Gross, W9ITT*

KNOBS FOR APC TYPE CAPACITORS

FOR years I have been looking for a method of adding knobs to the small APC variable capacitors that normally require screwdriver adjustment. A method was finally found. I cut off a ¾-inch piece of ¼-inch o.d. copper tubing and slipped it over the screwdriver adjustment shaft. After it was soldered in place, a knob could be added.

— *Stanley O. Andrews, W4AHW*

CUSTOM-MADE NAME PLATES

ALL you need to make attractive custom-designed name plates for the new rig are a package of transmitter decals (Tekni-Labels, Burbank, Calif.), narrow strips of aluminum, clear finger polish and a piece of crocus cloth or polishing paper.

The strips are cut to the desired width and length, a mounting hole drilled at each end, polished with the crocus cloth or paper, cleaned of abrasive dust and given a quick even coating of nail polish. After the polish dries, the decal may be affixed and allowed to dry thoroughly. Then one or two more coats of polish should be applied, each coat being given sufficient time to dry completely.

The result is an inexpensive indicator or name plate that is commercial looking in appearance. As the drying of the nail polish is tricky, since it dries so rapidly, it is best to experiment first before going into production. The instructions supplied with the Tekni-Labels should be followed closely.

— *Rev. Joseph F. O'Reilly, W9UFL*

ANOTHER METHOD OF STARTING MACHINE NUTS

I RAN across an item the other day which should prove of interest to those who build or service their own gear. It is merely another method of starting machine nuts in inaccessible places, but it seems to work as good or better than any other well-known way.

To apply the idea, a piece of solder is laid across the nut and given a slight tap with a hammer. This drives the solder into the hole and against the threads holding the nut securely. The screw is then started in from the opposite side of the nut. After the screw has *started*, the solder may be released by giving it a slight pull.

This method has been used with various sizes of nuts up to and including the 1-inch type. It worked equally well in all cases.

— *Robert B. Walker, W8MIH*

ANOTHER "STARTING NUTS" KINK

WHEN space limitations make it impossible to use either your hands or a regular tool to hold a nut while the screw is being started, try binding the nut in position with surgical adhesive tape. Punch a hole in the tape to permit the screw to pass through, and then work the tape and nut into position with the aid of a slim tool. Press the tape onto the surrounding surface, and if the screw is one that you may want to remove in the future, leave the tape in place for the next cycle.

More difficult cases can be handled by cementing the nut to a strip of cardboard. Model airplane cement or any other quick-drying binder will hold the nut firmly until the screw is started.

— *George W. Tappan, W1WOA*

A NOVEL FEED-THROUGH INSULATOR

AN inexpensive feed-through insulator can be quickly made by using parts from the junk box. A polystyrene rod or the center portion of a piece of coax is drilled and tapped to take a 6-32 threaded rod. A rubber grommet of the proper size is placed over the rod as shown in Fig. 1-21.

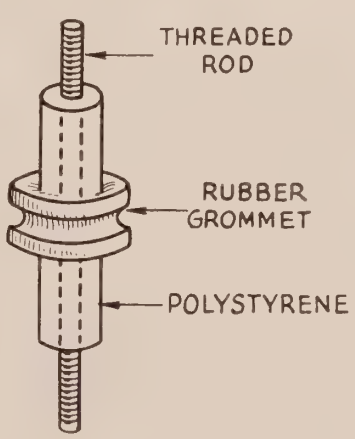


Fig. 1-21

The threaded rod may be a 6-32 machine screw with its head removed.

— *J. R. Pivnichny, KN3EOV*

DON'T CLEAN CERAMIC MATERIAL!

KEEPING equipment clean plays an important role in routine equipment maintenance. However, care should be exercised when using solvents such as alcohol, carbon tet, or other wax dissolving substances around ceramic material such as steatite, isolantite, etc.

Most ceramic material used in switches, tube-sockets and the like are impregnated at the factory with a waxy substance. This prevents moisture from collecting in the small pores of the material. When this substance is removed by the cleaning solvent, the voltage breakdown point of the material is decreased, leakage may develop, and general insulating quality, especially at high frequencies, will suffer.

A COAXIAL STRAIGHT ADAPTER

THE connection of two or more lengths of RG-8/U (52-ohm) coax requires the use of a PL-275 straight adapter, which is often hard to procure. On the other hand, chassis-type receptacles, SO-239, are plentiful on chassis of surplus equipment.

A very practical straight adapter can be made by removing the flanges from two chassis receptacles, either in a lathe or by means of a hacksaw, and filing flush with the diameter of the connector. The normal protruding connections are then soldered together as shown in Fig. 1-22, keeping both pieces on center line as much as possible. Next, wrap a piece of sheet metal completely around and over the gap, overlapping the start of the sheet slightly. This continues the shielded portion. Finally, solder along all the edges.

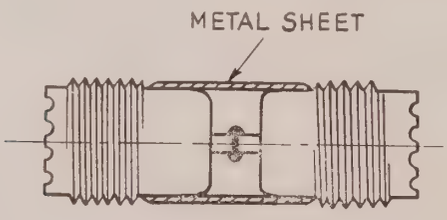


Fig. 1-22—W8HXB's coaxial straight adapter.

To facilitate soldering, the sheet can be held snugly against the connectors by winding a couple of turns of wire around the outside. The wire can be removed after the solder freezes.

— *W. W. Peterka, W8HXB*

TUNING WITH DIELECTRICS

WHEN the plates of a neutralizing capacitor or similar tuning device approach each other, danger of a voltage breakdown increases. The introduction of a strip of dielectric material between the fixed plates increases the capacitance without necessity for moving the plates closer together.

For example, two 1-inch square plates ¼ inch apart have a capacity in air of about 0.9 μμf. Introducing a polystyrene strip in the gap changes the capacitance to almost 2.5 μμf. A piece of plate glass shoots the capacitance up to almost 6.3 μμf. The dielectric may be made adjustable or may be fixed permanently once the desired capacitance is reached. Remember, however, to choose a material that has low loss at the operating frequency.

— *Frank Cronin, W4WOB*

DRILLING HINT

WHEN modification of a unit includes drilling holes in its steel chassis, the following trick can often save trouble that might follow after the modification is made. Insert a small magnet under the area to be drilled and, if possible, inside the chassis. The magnet will catch the steel shavings which might otherwise collect in spots and endanger the original circuitry.

— *J. Wimmer, W8RPX*

REMOVING HOT TUBES

THERE is nothing new about this idea but even so it bears repeating. A simple method for removing hot tubes from "hard to get at" places is to wind a rubber band around each of the jaws of an ordinary pair of pliers. This makes an excellent tool for gripping and removing the tubes.

— *Lewis G. McCoy, W1ICP*

SPARE TUBE STORAGE

TO PREVENT those embarrassing hours of silence because of tube failures, almost every ham, at one time or another, makes some attempt to keep spare tubes on hand; some even striving to have on hand, at all times, a tested spare for each socket. These attempts usually run afoul of storage and inventory problems, so that a tube failure still results in a mad scramble for a spare.

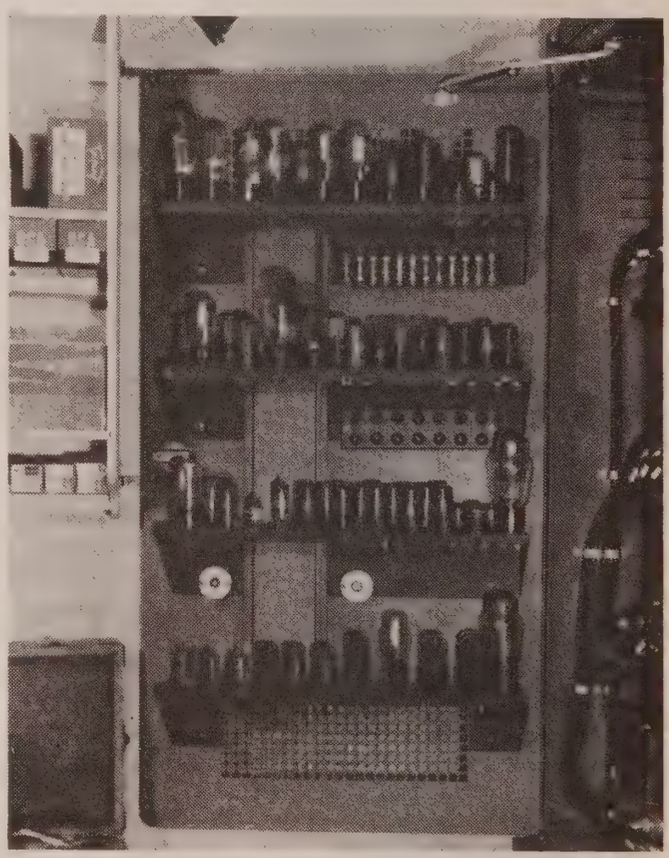


Fig. 1-23—Racks for spare tubes, spare fuses, and indicator lights mounted on rear door of rack cabinet. Two tube pin straighteners are also permanently mounted here to insure availability.

One happy solution to this problem is to store the tested spare tubes in racks, mounted on the back door of the rack cabinet, as shown in Fig. 1-23. The racks are cut from chassis bases 17 inches long and 3 inches deep, drilled for the requisite sockets, and then painted with crackle enamel to match the rack cabinet.

After sockets are inserted in the proper holes, the racks are mounted on the rack cabinet door at the approximate level of the chassis for which they hold the spare tubes, and the tubes are inserted. Small racks for spare indicator lamps and fuses are also mounted on the cabinet door, as are straighteners for tube pins, so that they are always available when needed.

By marking each socket with the designation of the tube which it should hold, inventory is a matter of seconds, as removal of a tube immediately exposes the number of the tube to put on the want list.

— *Ronald L. Ives*

USING THE COAXIAL FEED LINE AS AN A.C. EXTENSION CORD

A HEAVY-DUTY 115-volt extension cord that will reach to the top of a tower or out to the mobile rig is not always readily available when the electric drill, grid-dipper or soldering iron must be used at the outside location. If your next beam or mobile project necessitates outside use of electric tools or instruments, and if you do not have one of the relatively expensive a.c. extension lines on hand, consider using the coaxial feed line for carrying 115 volts to the desired location.

The homemade adapters that permit running 115 volts a.c. through the coax are shown in Fig. 1-24. A standard dual a.c. outlet is equipped

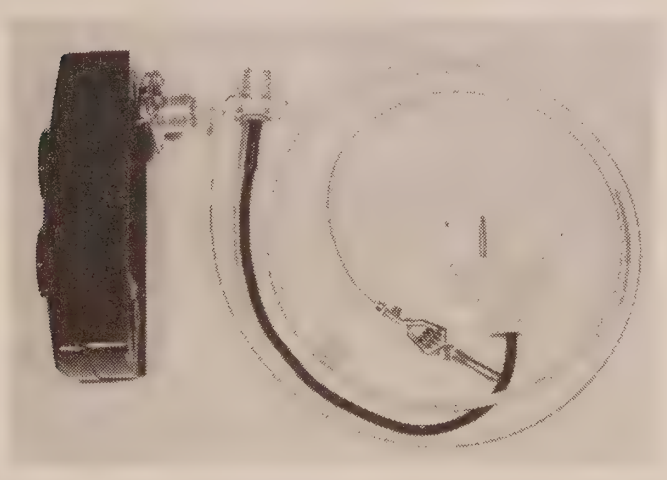


Fig. 1-24—The assembly at the left is used at the outside end of the coaxial feed line when the latter is used as a 115-volt extension cord. The unit at the right is used to connect the "shack" end of the coax to a 115-volt a.c. outlet.

with a female coaxial chassis receptacle (type SO-239) as shown at the left side of the photograph. This assembly permits connection to a tool or instrument at the "work" end of the line. The unit to the right side of the illustration mates with the "shack" end of the feed line and consists of a type SO-239 receptacle, a pair of leads, a test clip and an a.c. plug. The a.c. plug shown has one of the prongs removed, but this modification is not actually necessary. Notice that the test-clip lead is connected to the outside shell of the coax receptacle. The lead connected to the center terminal of the SO-239 is terminated at one prong in the a.c. plug.

When preparing the feed line for 115-volt use *always make certain* that it is first disconnected from both the antenna and the transmitter (or antenna coupler). This will prevent the inadvertent application of power to the antenna and will thus prevent shock hazard and blown fuses. Next, connect the dual-outlet block to the outside end of the line. Now connect the test-clip lead to a *known* ground inside the shack, and then insert the one-prong a.c. plug into a 115-volt outlet. Power will now be available at the far end of the coaxial line providing the active prong of the a.c. plug has made contact with the "hot" side of the a.c. line. If power is not available at the outside end of the coax, it indicates that the a.c. plug is in contact with the "cold" side of the power line and, of course, it is necessary to reverse the plug.

If you can't talk the XYL into lending a hand inside the shack while you test for power at the far end of the line, it is a simple matter to make a one-man job out of the entire operation. Merely hang a test lamp at the output end of the line (place it where it may be seen from the shack) and then watch the lamp as you insert the plug. Color code or otherwise identify the correct plug-outlet combination so that future use of the system will necessitate no trial-and-error runs. — *Ken Glanzer, K7GCO*

SHOCK MOUNT FOR RELAYS

A SIMPLE and inexpensive method of reducing relay noise is shown in Fig. 1-25. The system shown has been used in the construction of a.c.-d.c. receivers (to mount variable capacitors) for years and, when used to support relays, reduces the sounding-board effect normally caused by the chassis or other mounting surface.

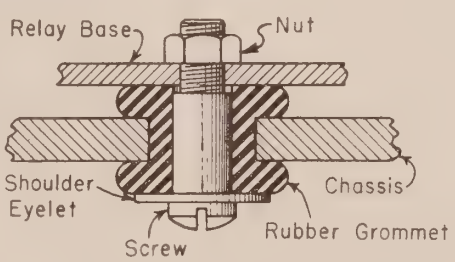


Fig. 1-25—Drawing of the rubber-grommet shock mount used by W3WPN.

Fig. 1-25 is almost completely self-explanatory. However, one precaution should be observed. Make certain the shoulder eyelet is shorter than the grommet thickness so that the grommet will be under compression when the nut is tightened. Otherwise, the cushioning action of the mounting will be impaired. Naturally, this system may be used to shock-mount tube sockets and other components. — *Sol Davis, W3WPN*

MAKING LARGE ROUND CHASSIS HOLES WITHOUT A PUNCH

THERE is no need of holding up work on an aluminum chassis just because punches for cutting large holes are not immediately available. Fig. 1-26 illustrates a set of four operations used here at W6GJZ whenever a large hole for a meter,

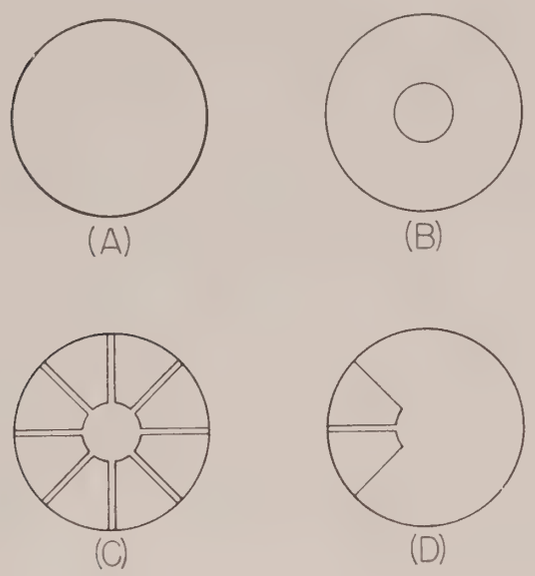


Fig. 1-26—Method of making large chassis holes recommended by W6GJZ. Operations (a) through (d) are listed in the text under the same headings.

tube socket, etc., is required. The steps involved in employing the system are as follows:

a) Use a pair of small sharp-pointed tinsmith's calipers to scribe the chassis as shown in Fig. 1-26. Make several *round trips* so as to score the metal deeply.

b) Drill a hole at the center of the circle. The hole must be large enough to accept a hack-saw blade. A pistol-grip saw is recommended for the operation ahead.

c) Make radial cuts — the more the better — from the center hole to the scored line marking the perimeter.

d) Bend each individual tab back and forth until it breaks free. After all of the tabs are removed, finish the job with a half-round file.

An alternative, if a pair of tinsmith's calipers is not available, would be to use an ordinary pencil caliper or a circular template for marking the hole. The saw cuts could then be made to the pencil line and the tabs removed with a small sharp chisel. The metal should be placed on a solid surface as the tabs are removed and the cuts should be made well inside the pencil line. This method worked out satisfactorily on 18-gauge aluminum and required about ten minutes' work per hole. — *Dr. Russell R. Crane, W6GJZ*

DEBURRING TOOLS

JAGGED BURRS around screw, ventilation, bezel and socket holes are not only unsightly indicators of poor workmanship but also constitute a considerable hazard, as the burrs have and retain razor-sharp edges.

Deburring is an irritating and time-consuming job under most conditions because of lack of suitable tools. With soft metals, a knife blade is partially satisfactory, but may slip out of the hole being deburred, cutting a deep gouge in the panel, or a gash in the hand. Small hand grinders are somewhat more satisfactory, at a cost of about $25.00 each, plus about one cent per hole for wheel replacement. Metal countersinks have been used, but these, having a 55- or 60-degree included angle, ream the hole almost as fast as they remove the burr.

Quite satisfactory deburring can be done with a carpenter's wood countersink having an included angle of approximately 90 degrees. These, which come in all sizes up to about ¾ inch in diameter, are supplied with a square shank. To convert a carpenter's wood countersink into a deburring tool, grind off the corners of the shank and drive the shank into a plastic screwdriver handle from which the blade has been pulled.

Performance will be most satisfactory if the axes of the handle and of the countersink coincide. Length of the finished tool should be approximately six inches, with a tolerance of about plus or minus one inch to suit the materials available and the user's personal taste.

Larger holes are easily deburred by use of an automotive valve-seat reamer. These come with four, five, and six blades and cost from $2.00 up. No changes are needed in this tool, and those with a larger number of blades, such as six, are preferable to the four-bladed type. When only steel is to be used, an abrasive valve seater, which ls merely a conical grindstone with a large included angle, such as 105 degrees, is very effective. This cannot be used with soft metals, such as aluminum, as the abrasive will plug up after deburring only a few holes.

— *Ronald L. Ives*

HANDY ADJUSTMENT TOOL

THOSE who have transmitters built in a one-piece cabinet know that internal adjustments sometimes can be made only by pulling the transmitter completely out of the cabinet. My Johnson Valiant transmitter has a control on the time-sequence circuit and in order to adjust this control the transmitter must be removed from its cabinet.

To overcome the above problem, I use a length of wire bent into a small right angle as shown in Fig. 1-27. The wire is small enough to go through

Fig. 1-27—K4AVU's tool for adjusting hard to get-at slotted controls.

the perforated holes in the cabinet and fits into the slot on the end of the control. The wire is used to adjust the control to the desired position. One caution: be sure the high voltage is turned off whenever the adjustment is being made!

— *Paul G. Marsha, K4AVU*

HOMEMADE WIRE STRIPPER

An old hacksaw blade, two washers, a machine screw and a nut are the only parts needed for making the simple wire stripper shown in Fig. 1-28.

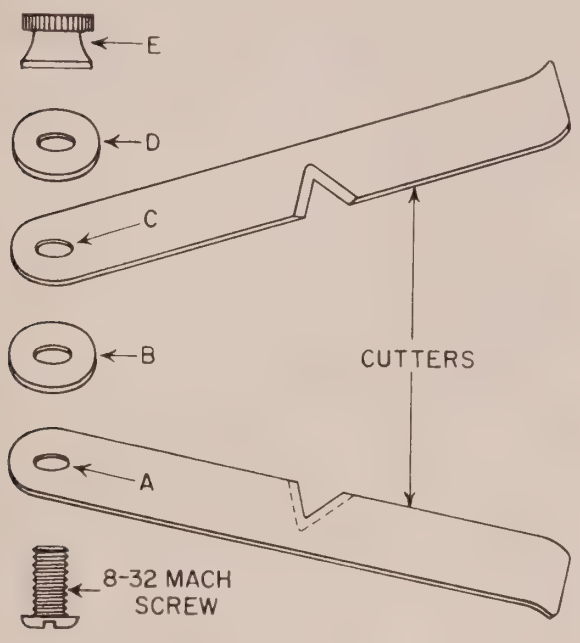


Fig. 1-28—Sketch of the homemade wire stripper. The cutters are made from an old hacksaw blade. B and D are No. 8 flat washers. A, C and E are referred to in the text.

Length of the stripper cutters may suit individual taste — anything from half the length of a hacksaw blade down to one inch or so. A miniature model with 1-inch cutters is a handy tool to carry in one's pocket.

The exploded sketch of the stripper shows the various components arranged in the order of assembly. The machine screw passes through A, B, C and D and is locked in place by E. The nut illustrated is a knurled terminal removed from a dead dry cell. In the final assembly the lead end of the machine screw is soldered to the top side of the locking nut.

The cutter members are prepared with the aid of a vise, a grinding wheel and a half-round file. The blade may be cut into sections of the desired length merely by clamping it in the vise and then bending. One edge of the file is used to cut the V-shaped cutting notches. The grinding wheel is used to remove the teeth, bevel the outside edges of the cutting slots and smooth off the open ends of the cutters. The holes at the ends of the cutters are the ones already found in the hacksaw blade. Any attempt to drill new holes with an ordinary drill will be most unsuccessful.

It is not necessary to round the ends of the cutters outward as shown. However, this finishing touch may be added by applying heat and then bending with the aid of the vise.

— *Billy E. Allen*

ANOTHER INEXPENSIVE WIRE STRIPPER

In the field of inexpensive ready-made wire strippers, the Mueller No. 27 test clip just about takes the cake. This clip — the 3-sided mesh teeth job rated at 20 amperes — sells for 11 cents (mail-order house price) and does a swell job of removing insulation from hookup wire.

— *Jack Nelson, W2FW*

DEMAGNETIZING TOOLS

Screwdrivers and other small tools which have accidentally become magnetized may be made to lose this undesirable property with the aid of soldering gun. After the trigger of the gun has been pulled to the "on" position, pass the tool to be demagnetized through the "hairpin"-shaped tip. One or two passes through the strong magnetic field that surrounds the tip will usually free the tool of bad habits such as clinging to iron filings, picking up steel wool, screws, etc.

— *Leslie E. Downs, W9YSZ*

USING TAP WRENCHES AS HOLDER FOR COPING SAW BLADES

As most constructors sooner or later find out, many chassis and panel holes are difficult to cut unless a set of fairly expensive punches is on hand. Cuts that can be made with a hacksaw or a regular coping saw assembly are usually confined to the outer edges of a large chassis or panel because of the travel limitation imposed by the frame of the saw.

One dodge around this problem is the use of a coping saw blade clamped between a pair of dime store tap wrenches as shown in Fig. 1-29. The *distance in* that can be reached with this tool is limited only by the length of one's arms. It does take a bit of practice to learn to keep the blade taut while the cut is being made, but once mastered it is possible to make the most complicated cuts.

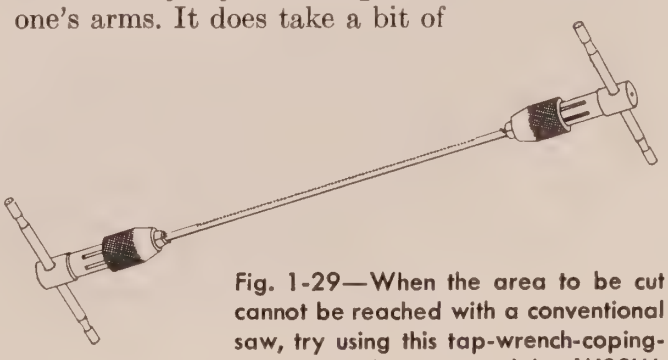


Fig. 1-29—When the area to be cut cannot be reached with a conventional saw, try using this tap-wrench-coping-saw assembly suggested by W3SUJ.

— *Dick Knoth, W3SUJ*

MEDICAL TOOLS FOR THE WORKBENCH

The act of holding the wire leads of a diode or transistor in place to absorb heat while soldering, holding a soldering iron in the other hand, and then reaching for solder with the third hand is quite a problem!

One solution is to use any of the large assortment of surgical clamps known by a variety of names: hemostats, snaps, mosquito forceps, kelly clamps. These instruments all have an automatic locking device yet have the same grasping action of pliers. They can be quite expensive if purchased new but probably can be obtained reasonably second hand or as discards from hospitals. — *Dr. Ernest S. Pentland, VE3DWP*

BASIC TOOL KIT FOR THE BEGINNER

WHEN a newcomer starts out in amateur radio, he soon finds that one of the "must" items around the ham shack is a good set of tools. Whether he is building gear or maintaining his present equipment, there will be special tools, particularly suited to radio work, that he'll be needing in his tool box. He may get by for a while using a pair of scissors for wire cutters, or the family carving knife for wire-stripping, but sooner or later he'll find these makeshift substitutes are inadequate for the job. When that time comes, he is confronted with the problem of exactly what kind of tools he should buy.

The first item on the list should be a soldering iron. The iron to use for general radio work is a 60- or 100-watt job with a $\frac{3}{8}$- or $\frac{1}{4}$-inch tip (such as the Drake model 400 used in the ARRL laboratory). If you buy an iron with a larger tip, you'll find there will be many places around a chassis you won't be able to reach. Larger-sized irons and tips *are* needed when doing sheet-metal work or when it is necessary to transfer a great amount of heat to the work.

When wrapping wires around terminals or when making connections to points that are difficult to reach, long-nose pliers are a radioman's "must." Long-nose pliers are available with or without wire cutters at the base of the jaws. The cutters are of little help in cutting wires close to sockets or the chassis, but often wires will be easy to reach, and having the cutters on the long-nose pliers will save time. The cost difference between pliers with and without cutters is so slight that it is worth while to purchase those with the cutters.

When wrapping wire around terminals and then soldering, many times there are short lengths of wire protruding that must be snipped off. This is done with a pair of diagonal-cutters. With these it is possible to reach into very cramped spaces and cut wires. The three tools listed, a soldering iron, long-nose and side-cutting pliers, together with a screwdriver, are probably the most important that the amateur uses.

TABLE I-1
Beginner's Tool Kit

Electric soldering iron, 60 to 100 watts
Solder (rosin-core)
Long-nose pliers, 6-inch
Diagonal cutting pliers, 6-inch
Soldering aid (Hytron)
Screwdriver, 6- to 7-inch, $\frac{1}{4}$-inch blade
Screwdriver, 4- to 5-inch, $\frac{1}{8}$-inch blade
Hand drill, $\frac{1}{4}$-inch chuck or larger
Drills, $\frac{1}{8}$- and $\frac{1}{4}$-inch, and Nos. 18, 28 and 33
Pliers (combination)
Pocketknife
Two large coarse files, one flat, one rat-tail
Two small files, one flat, one round
Keyhole saw (metal-working)
Hammer
Center punch
$1\frac{1}{8}$-inch socket punch
Small paintbrush
Reamer
Carpenter's brace

A cheap paintbrush makes an excellent clean-up tool for removing bits of loose matter from a chassis or for brushing out dirt.

Small holes in metal and some insulating materials are drilled with twist drills and a hand drill. Most hand drills will only take drills up to $\frac{1}{4}$-inch diameter and one has to look for other methods if larger holes are involved. For holes up to $\frac{1}{2}$-inch, a common method is to start the hole with a small twist drill and the hand drill, and then finish with the large drill held in a carpenter's brace. Another, and perhaps preferable, method, is to use a reamer held in the carpenter's brace. For still larger holes, such as the $\frac{5}{8}$- and $\frac{3}{4}$-inch holes for miniature sockets and the $1\frac{1}{8}$- and $1\frac{1}{4}$-inch holes for bakelite and ceramic octal sockets, radio chassis punches are recommended. These punch out a clean hole as a bolt is tightened, and they work beautifully in the materials normally used for chassis material.

A hack saw, large coarse flat file, and rat-tail

Fig. 1-30—Representative group of the tools needed in a beginner's tool box. They include hand drill, twist drills, knife scale, screwdrivers, soldering iron, solder, soldering aid, files, hammer, pliers, center punch and brush.

file also are helpful for cutting and enlarging holes on a chassis.

In addition to the tools outlined earlier, Table I-1 gives the contents of a basic tool kit for the ham. An electric hand drill is a luxury unless one is doing considerable work in iron and steel, as in building an antenna tower, where it becomes a "must." However, the tools described will prove to be adequate for most jobs the newcomer encounters.

— Lewis G. McCoy, W1ICP

TOOLS & TRICKS — OLD AND NEW

WHILE the abuse of tools is not a practice to be universally recommended, there are many small jobs that most hams have learned to make easier by using some tools that weren't necessarily designed for the purpose. For instance, if you have to do all your chassis work with a hand drill that won't take a drill larger than ¼ inch, enlarging holes to ½ inch can be a tedious process. But if you have a dime-store carpenter's brace, you can clamp a rat-tail file (minus the handle) in the brace and do the job easily. Simply turn the brace in a counterclockwise direction and the file will walk through a chassis as though it were cheese. You can get these files up to ½-inch diameter or more. Don't rotate it in the opposite direction, because the file will lock up in the hole and snap off.

If you have a lot of holes to tap in sheet metal, you can speed up the job of threading by using the tap in the hand-drill chuck. You will have to use a little care to avoid snapping off the tap, but if you put a drop of oil on the tap every hole or two, hold the drill steady and back it up whenever it sticks, you shouldn't have any trouble. A two-speed drill at low speed is ideal for this sort of work.

If you are making a metal box, or putting a bottom plate on a chassis, it is seldom that all of the holes in the pieces to be joined will line up accurately, making it difficult to get the screws in place. After the first screw has been started, you can line up the others by jabbing an ice pick through the two holes and prying them into line. If they won't stay in line long enough to get the screw started, use the ice pick in an adjacent hole, prying in the direction that will bring the desired holes into line. The ice pick, as well as a machinist's scriber, is also an aid in steering a nut onto the end of a screw in a place where you can't reach it with your hand. If the scriber is of the type that has one end bent at right angles, you can use the bent end to rescue the nut if it falls off. As simple an item as a pair of tweezers can save a lot of wear and tear on the nerves.

In most dime and hardware stores you can buy very cheaply a cast-iron handle that holds tapered keyhole saw blades. The teeth of the blades are fine enough so that they will cut aluminum quite readily and can be used for cutting out large holes in panels or chassis. If you want to hold the chassis in a vise while you're working on it, place a block of wood a little thicker than the depth of the chassis underneath. The jaws of most vises won't clear the chassis otherwise.

Several manufacturers have recognized the need for special tools of the gadget class in radio-assembly and repairing work. Most hams are familiar with the screw-type socket punches made by Greenlee and also by Pioneer. But perhaps you haven't noticed that they have four marks around the "cup" part that make it possible to center the punch when the pilot hole is much larger than the screw. Just scribe lines at right angles through the center of the hole and match up the centering marks on the punch with the lines on the chassis. This makes it easy to increase the hole diameter to take a five-prong socket, for instance, where an octal socket originally was mounted. The easy way to use these punches is to clamp the head of the screw in a vise and cut the hole by turning the chassis or panel instead of the screw.

Most hams working with tools know about the automatic center punch that eliminates the need for a hammer when making hole centers in metal. Simply press down in the handle and an internal spring gives the punch a kick that will go through thin aluminum if you aren't careful. The tension is adjustable.

Hytron "Soldering Aids" are fast becoming well known as indispensable tools in radio work. In case you haven't seen one, it's a harmless-looking gadget with a metal insert at either end of a wood handle. One end is forked so that it can be slipped over the end of a wire that is to be unsoldered. By guiding the fork up close to the connection you're working on, you can wiggle the wire to loosen it up without burning your fingers. It is especially effective in removing wrap-around connections. The metal fork is coated so that it won't get gummed up with solder itself and the mass is small enough so that it doesn't conduct all the heat away from the joint as a pair of pliers often does. The other end of the tool is a tapered spike that can be used to remove old solder from terminal holes. The "Aid" will be found to have many other uses — in restringing dial cords, for instance.

Most radio-parts catalogs carry a small angle-mounted mirror with a long handle that can be used dentist-fashion to get a peek at some hidden part. Some of these are illuminated with small batteries.

Most of these tools are inexpensive items and are of the sort that can take the cussing out of otherwise awkward jobs. They are well worth adding to the ham's workshop equipment.

— Donald H. Mix, W1TS

HOLE-DRILLING AID

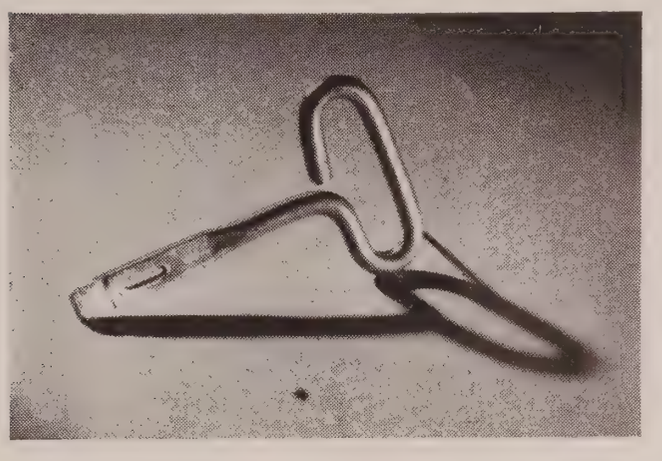
SOMETIMES, while constructing or revising equipment, it is necessary to drill a hole in the chassis from the bottom since parts already mounted on the top side are in the way of the drill. I have found that a sharp hand awl or ice pick, when pressed down and rotated from the top of the chassis, will easily pierce the aluminum

so that the hole can be positioned and drilled from the opposite side. This method is especially useful when a drill press is used and such components as i.f. transformers and tube sockets have already been mounted.

— *Mel Hart, WØIBZ*

CAN-OPENER SCREWDRIVER

ARE you constantly hunting for a small screwdriver? Try making one: Take an opening key that comes with sardine or coffee cans, file or pound it flat to the desired thickness and width



to fit the screw head. The result, shown in the photograph, is a miniature screwdriver.

— *Stuart M. Mulne, KN8LEA*

BOLT ASSEMBLY HINT

HERE's a convenient way to hold a nut in position to thread it on an out-of-reach bolt. Wrap the end of a length of lead solder around the nut. Using the free end of the solder as a handle, place the nut over the bolt and start the threading. The job can be finished by tightening up from the opposite side with a screwdriver. This method allows positioning of the nut while the thread is started, but will not grip the nut so tight that the solder can't be removed for the final tightening. — *Charles J. Boutell, W5YSC*

CARPENTER'S TRICK

FIG. 1-31 shows a carpenter's trick that is applicable when trying to line up elements of a beam. Stretch a piece of fish line or string taut along the side of the elements from the end of one to the end of the other. Place a block of wood approximately ¾ inch square under the string at

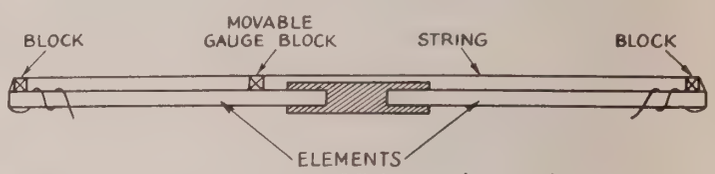


Fig. 1-31—A method of lining up beam elements.

either end. Take a third block of wood of the same thickness and using it as a gauge, move elements from side to side until the gauge blocks shows the string to be equidistant from elements at all points. Secure the elements in place.

— *Edward P. Foster, jr., K4BZL*

TIPS ON USING SHIELDED WIRE

SHOWN in Fig. 1-32 is a method of preparing the ends of shielded wires which produces a neat and simple termination It is in general use in commercial practice, but apparently has been overlooked by hams.

The sketches tell the story. First, bend the wire, as at A. Next, slide the shield over the bend (B) using either a blunt instrument or your fingernail to separate the strands. Pull the short end out of the shield, as in C, and then pull the shield taut as in D. The end of the shield may then be cut to desired length and tinned for soldering. The result is neat and strong, with no frayed ends to short-circuit the high voltage.

This method can also be used to tie into the middle of a shielded run, as is necessary when wiring the heaters of several tubes in parallel. The type of connection is shown in sketch E.

— *Paul A. Quinn, W1QXU*

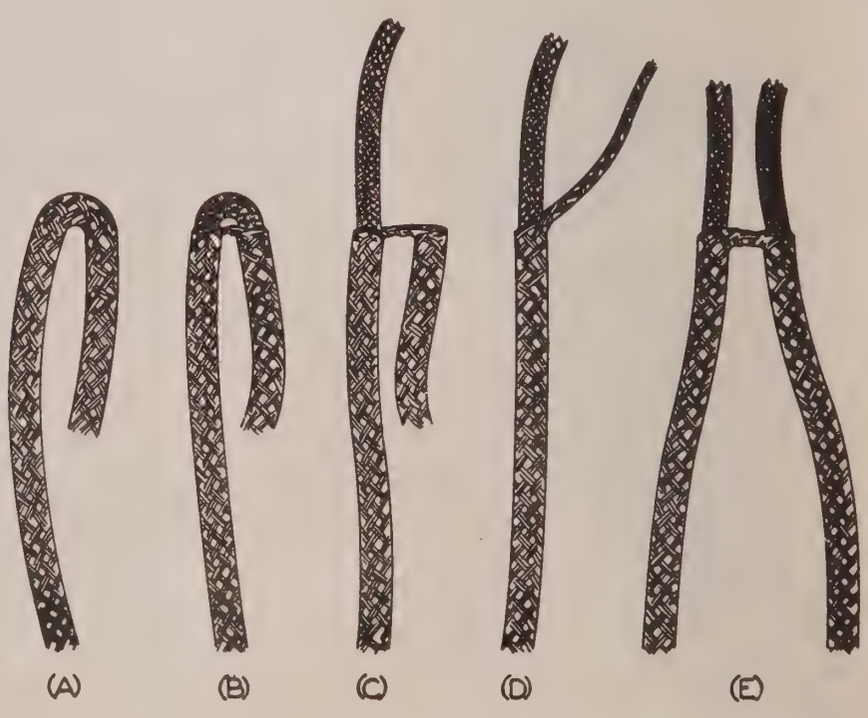


Fig. 1-32—Here's a simple way to make neat connections with shielded wire. Widely used in commercial practice, it should find equal favor among hams.

2. Hints and Kinks . . .

for the Receiver

USING 1N34s TO PREVENT RECEIVER OVERLOAD

After installing a kilowatt final amplifier, I was troubled by very slow recovery of the receiver in going from transmit to receive after the send-receive switch was thrown. It took as long as three seconds for the receiver to return to normal, especially when using sharp crystal selectivity. Putting a neon bulb across the antenna terminals did protect the antenna coil on the receiver, but had no effect on receiver overloading. Attempts to time the relays weren't too successful, since getting the relays to open in the proper sequence would result in the wrong closure sequence.

Installation of two germanium diodes (1N34 crystals) across the antenna terminals of the receiver completely eliminated the slow recovery and effectively prevented receiver overload regardless of relay timing. Apparently, the crystals begin conduction at a fraction of a volt, and bypass anything above this level so that it does not enter the receiver. No effect on the strength of received signals was noted, and there was no TVI as might be possible from the use of nonlinear elements in the antenna circuit.

The crystals were installed directly across the antenna terminals of the HRO-5, with the polarities of the crystals such that one was opposite in polarity to the other. The same system was tried on a BC-779 receiver with equally gratifying results.

The author hopes that this novel idea may be of help to someone who is bothered by slow receiver recovery caused by transmitter energy feeding back through the antenna relay to the receiver.

— *Sidney L. Gerber, WØTAI*

EARPHONE PADS

Gerrard industries, Jackson Heights, N. Y., are manufacturing telephone ear pads that work well with regular amateur-type headphones. The pads sell for 25 cents each and are distributed through some of the 5- and 10-cent stores. They are soft, washable, and carry an adhesive which really holds them in place against the phones. Because the material is easily cut, it is possible to trim the pads for almost any size phones.

— *John Messler, W8MUL*

TRANSISTOR CONVERTER

Shown in Fig. 2-1 is a circuit diagram of a 40-meter transistorized crystal-controlled converter. It is a simple circuit, yet works surprisingly well considering the small number of parts it uses. The circuit is basically a Pierce oscillator with an untuned collector. The transistor used is one of the less expensive types and the crystals can be surplus. Basically, the circuit oscillates as a crystal-controlled oscillator while the input signal is injected into the base. After mixing, the desired signal is picked out by a tunable receiver. I use a 3 to 6 Mc. ARC/5 receiver with my converter. Resistor R_1 may have a value from 100,000 ohms to 1 megohm. However, I found 390,000 ohms worked best in my circuit.

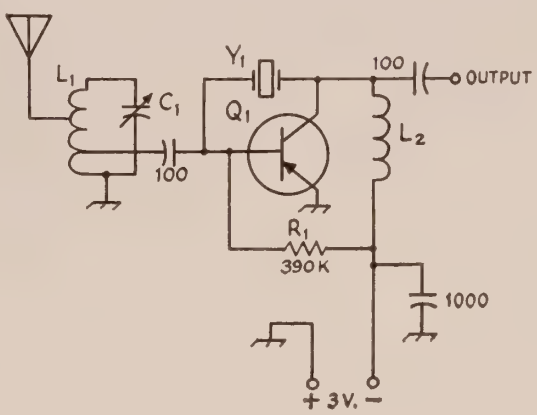


Fig. 2-1—Transistor crystal-controlled converter. All capacitors are in $\mu\mu$f., resistance are ohms, resistors are ½ watt.

C_1—100 $\mu\mu$f. variable capacitor.
L_1—30 turns No. 22 enam. wire, close wound on 5/16 inch dia. tube. Transistor tap at 3 turns from cold end, antenna tap 12 turns from cold end.
L_2—1- to 2.5-mh. r.f. choke.
Q_1—2N247, 2N170.
Y_1—3700 kc. to receive 7000 to 7300 kc. when tuning receiver 3300 to 3600 kc.

With 3 volts on the collector, the unit draws about 100 μa. When the crystal is removed, the collector current will jump to 500 to 1000 μa. This is a good indicator to show when the circuit is not oscillating. The converter can be used to cover other bands by choosing the proper crystal and changing the input circuit to tune to the new frequency.

— *Milton K. Foxworthy, W9BNW*

TRANSISTOR B.F.O.

FIG. 2-2 shows a transistor b.f.o. that can be with any receiver having a 455-kc. i.f. It is basically a Colpitts oscillator and uses a 2N190 transistor. I built the unit in a b.f.o. can discarded

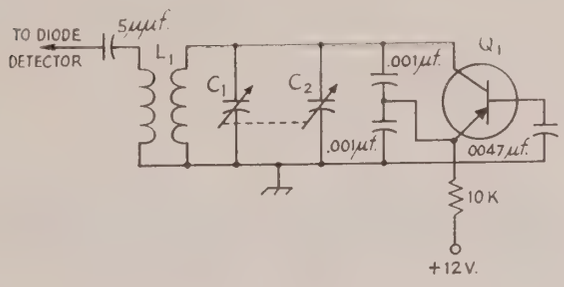


Fig. 2-2—Transistor b.f.o. The tuned circuit L_1 C_1, C_2, is the b.f.o. assembly from a 1.5 to 3 Mc. ARC/5 receiver. Q_1—2N190, CK768, 2N107

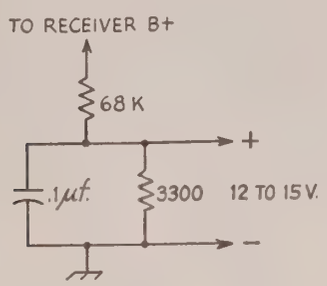


Fig. 2-3—The voltage divider connects to a 250 to 300-volt source. Resistors are ½ watt.

from a 1.5 to 3 Mc. ARC/5 receiver. The oscillator tank $L_1C_1C_2$ is the b.f.o. coil assembly from the 1.5 to 3 Mc. ARC/5 receiver. The oscillator is coupled to the receiver detector through the 5-μμf. capacitor. Since the unit requires only 12 volts at 60 μa., it makes a convenient b.f.o. for mobile operation. It can also be incorporated into the home receiver by using the voltage divider shown in Fig. 2-3. The divider is connected to the receiver B-plus line.

— Charles Hartley, K6GQL

VARIABLE BANDWIDTH FOR THE HEATHKIT Q MULTIPLIER

AFTER reading "Variable Band Width *Q* Multiplier," *QST*, April, 1957, I converted my Heathkit *Q* Multiplier for variable bandwidth in less than 15 minutes. All that was needed was a 2-inch piece of wire, and the entire job consisted of cutting and reconnecting one wire and ungrounding one terminal.

Results were excellent in that adequate bandwidth for phone reception was obtained. Also, the ability to change bandwidth to meeting varying conditions made some signals readable where otherwise they would have been lost.

Basically, the modification allows the NULL control to operate on both PEAK and NULL and connects the PEAK pot across the series resistor in the *broad* position of the switch. The *broad* position then becomes variable, with the PEAK pot acting as the variation control while the NULL pot acts as the regeneration control for both the NULL and PEAK condition.

A complete description — Heathkit style — of the modification follows:

1) The wire running from the switch (Terminal 7) to the PEAK adjustment control is cut at a point about ¾ inch from the switch.

2) The ¾-inch piece of wire (from Terminal 7) is then soldered to Terminal 6 of the switch.

3) The 1-inch piece of wire (from the PEAK control) is now soldered to Terminal 9 of the switch.

4) Next, connect a 2-inch piece of wire between the outside terminal of the PEAK control (this terminal previously unused) and Terminal 11 of the switch.

5) Remove the lead between the outside terminal of the PEAK control and ground.

Incidentally, the reason why the connection from switch Terminal 9 is not made to the previously grounded end of the potentiometer is that the span to the other end is much shorter.

— Cal Enix, W8ZVC

ACCURATE ZERO BEATING

BECAUSE the audio frequency response of most receivers drops rapidly below a few hundred cycles per second, it is not possible to zero beat two signals exactly by listening to their audio beat note on a receiver's speaker or earphones. A more accurate indication of zero beat can be obtained by measuring either the receiver's a.v.c. voltage or its second detector output voltage with a vacuum tube voltmeter. When the difference in frequency between the two signals is only a few cycles per second, the voltmeter needle will fluctuate with the beat signal. The fluctuations become slower as the frequency difference becomes smaller and a large dip is obtained when the frequencies are exactly equal. However, this dip is extremely sharp and it sometimes requires a steady hand to zero beat the two signals exactly.

— D. F. Zawada, K8EMS

SOURCE OF HUM IN OLD RECEIVERS

MY six-year-old receiver, after traveling all over the country without benefit of normal servicing, finally required a complete overhaul. One of the most obvious defects was the strong a.c. hum that appeared consistently in the output of the set.

Although all new capacitors — both paper and electrolytic — were installed in the receiver during the overhauling process, the hum was found to be just as bad as ever when the set was turned on. After much checking, the trouble was traced to defective ground connections.

This particular receiver is one of the type that utilizes the metal mounting rings for the tube sockets as ground tie-points. These rings are in turn fastened to the chassis by means of rivets. During the years of use, the rivets had worked loose, thus allowing a coating of oxidization to form between the rings and the chassis. Naturally, a set of very poor ground contacts was the result. A little solder between the rings and the chassis did the trick as indicated by complete elimination of the hum.

— Lee Dilno, W8DAP

21-MC. CALIBRATION FOR THE HQ-129-X

THE following is a simple and convenient method of providing 21-Mc. calibration for the HQ-129-X receiver.

Using a crystal-controlled frequency standard, and by adjustment of the two tuning dials, set number 2 of the calibrated bandspread scale (the uppermost ring of numbers — 0 to 200 — on the dial) as the position for 21-Mc. reception. With this setting of the controls, it works out that each higher number on the bandspread scale — after multiplication by 4 — equals the approximate number of kc. above 21 Mc. Therefore, by multiplying by 4 and then adding 21,000, the approximate frequency is readily determined.

For example, 25 on the scale corresponds to 21.1 Mc. ($25 \times 4 + 21{,}000 = 21{,}100$ kc.). With the scale set at 100, the approximate frequency is 21.4 Mc. ($100 \times 4 + 21{,}000 = 21{,}400$ kc.). The mental process of multiplication and addition may slow you up a bit at first, but soon becomes a routine matter.

The main tuning dial of my receiver is set at approximately 21.85 Mc. for 15-meter operation. The exact setting of the dial for each particular receiver should be determined by means of a frequency standard. Band-edge operation should also be checked against a standard.

— John Abbott, W6ZOL

SERVICE HINT FOR COLLINS SERIES 75A RECEIVERS

THE COLLINS 75A series receivers are famous for their frequency stability and calibration accuracy, but the rigors of time, humidity, and wear may cause the variable-frequency oscillator to shift and throw the dial calibration off to the point where it can no longer be corrected with the zero set. If the calibration error is the same on all bands, the variable oscillator is at fault. If only one band is off calibration, the first oscillator for that particular band should be suspected.

The 75A-3 at W4CEN, when new, was calibrated perfectly at the high-frequency end of all bands, but at the low-frequency ends it was necessary to move the zero set pointer three kc. to the left to correct the calibration. This pointer can only be moved four kc. either side of zero center. After a year's use, the calibration drifted off two more kc., so it was no longer possible to correct the calibration with the zero set. The oscillator unit is completely sealed and there is no provision for adjustment of the oscillator frequency. The Collins instruction books says to remove the oscillator unit and return it to the factory when this condition occurs. If the calibration error is very great, these instructions should be followed.

In my case, such drastic action hardly seemed necessary, and I cast about for some easy method to correct the calibration. A very small reduction in the capacitance across the oscillator coil was necessary to do this. The tube tables in the *Handbook* list the input capacitance of the 6BA6 tube used in the oscillator (V_{14} in the circuit diagram) as 5.5 $\mu\mu$f. The tables list a number of other miniature pentodes with a lower input capacitance, among them the 6AK5, with an input capacitance of 4.3 $\mu\mu$f. The base connections are different, but the difference is in the manner in which the cathode and suppressor grid connections are made to Pins 2 and 6. Since both these pins are grounded in the receiver, the 6BA6 and the 6AK5 may be interchanged. A 6AK5 was then substituted for the 6BA6 in the oscillator socket, and presto, the zero set moved back to only one kc. to left of zero at the low-frequency end of the dial.

Incidentally, there may be considerable difference in the input capacitances of the same type tubes produced by different manufacturers. I discovered that a Tungsol 6BA6 had an input capacitance sufficiently lower than an RCA 6BA6 to move the calibration two kilocycles.

In cases where it is necessary to move the zero set to the right to correct the calibration, an increase in capacitance is indicated. This may be obtained by the simple expedient of taking a short piece of No. 22 solid hook-up wire, remove the insulation from about one-quarter inch at one end, form a small loop and crimp it around the No. 1 or grid pin of the 6BA6 oscillator tube, wrap the wire around the other pins to form a semicircle, and plug the tube back in its socket. The length of the wire may be adjusted until the calibration is correct.

— Tom Brandon, W4CEN

FEEDBACK CURE

IF YOU are plagued by feedback — acoustical or r.f. — here is one way to get rid of it for good without fiddling around with ground leads or microphone cords.

The circuit is shown in Fig. 2-4. The only parts needed are a 115-volt a.c. s.p.d.t. relay and a

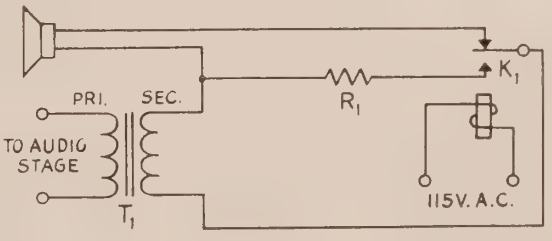


Fig. 2-4—W5AXI/MM uses this simple circuit for curing feedback.

2-watt resistor, R_1. The resistance of R_1 should be approximately equal to output impedance of the audio transformer and the relay may be actuated by the same power source used for the antenna relay.

When the transmitter is on, and the relay closed, the speaker is disconnected from the receiver and the resistor, R_1, is connected across the secondary of the receiver output transformer, T_1. The relay disconnects the resistor and restores the speaker to operation whenever the transmitter is turned off.

— Arthur E. Hutchins, W5AXI

Q MULTIPLIER FOR BC-312 OR BC-342

HERE is a hint for users of the BC-312 or BC-342 who wish to use these receivers with the Heathkit Model QF-1 *Q* Multiplier. The QF-1 will not tune to the BC-312 i.f. of 470 kc. To make the conversion refer to the QF-1 schematic and you will see a 3300-$\mu\mu$f. silver-mica capacitor in the tank circuit. Replace this capacitor with one with a value between 2800 and 3000 $\mu\mu$f., and retune the inductor to 470 kc. by adjusting the tuning slug.

Using a 2800-$\mu\mu$f. ceramic capacitor, the circuit came to resonance with the slug almost all the way in; so, if normal tolerances will not permit tuning to resonance at 470 kc., try a capacitor of 3000 $\mu\mu$f. Although I used an available ceramic capacitor which works very well, it is possible that the recommended silver-mica unit would improve the selectivity and *Q*. As it is, with the BC-312 series having such broad selectivity, the *Q* multiplier is a welcome addition when the going gets rough. — *Harry K. Long, W7CQK*

NOTE ON SURPLUS TYPE BC-348 RECEIVERS

THE dial calibration on BC-348 receivers can be greatly improved by adjusting the inductance of the oscillator coils. To provide this adjustment (except in J, N, & Q series) proceed as follows:

1) Make certain that the i.f. is correctly aligned at 915 kc.

2) Note whether the dial spread is greater or less than the actual frequency band covered.

3) If the dial spread is greater, the inductance is too small.

4) If the dial spread is less, the inductance is too large.

5) Remove the top and bottom covers from the oscillator compartment and drill and tap a 6–32 hole over the center of each coil which requires correction. The covers are thin and best results will be obtained if the holes are punched through with a tapering punch to give more material for threading.

6) In the holes over low inductance coils, insert a small powdered iron slug with 6–32 screw attached.

7) In the holes for the high inductance coils, insert a 1-inch 6–32 brass screw, with the head inside the coil.

8) By alternately adjusting the trimmer capacitor (near the high end of the dial) and the slug (near the low end of the dial) bring the receiver as nearly as possible into calibration. Lock the slug adjustments with a 6–32 nut and cut off any excess screw length to prevent catching on case.

If care is used, the calibration over most of the dial should be off not more than the thickness of one of the heavy calibration marks on the dial.

—···—

SINGLE-SIDEBAND reception with the BC-348 type receiver can be improved by adding a small variable capacitor to permit fine adjustment of the b.f.o. frequency.

A double-spaced unit having a maximum capacitance of approximately 2 $\mu\mu$f. is recommended for the job. If a made-to-order APC type is not available, a larger size can be modified by removing plates.

The capacitor may be centered above the "Volume" and "Beat Freq." controls by using a suitable bracket to avoid wires in the vicinity. The rotor should be grounded and the stator connected to Pin 5 of the 6F7 (VT-70).

Another installation places the vernier capacitor on the panel directly above the "C.W. Osc." switch. The rotor of the new vernier capacitor should be grounded, and the stator terminal connected to terminal "C" at the top of the c.w. oscillator inductor. Terminal "C" is already wired to Pin 6 of the 6F7 tube (VT-70).

— *George S. Carson, WØJV*

USING THE GONSET SUPER-SIX AHEAD OF A COMMAND RECEIVER

AN excellent, low-cost communications receiver can be assembled by adapting the BC-453 Command receiver (190-550 kc.) for use with the Gonset Super-Six converter. This combination has been used at this station for s.s.b., c.w. and a.m., and has outperformed several amateur receivers costing many times more.

The simple modification necessary to the Command receiver is accomplished by removing approximately 180 turns from one end of L_1, L_3 and L_5, the antenna, r.f. and oscillator coils, respectively, in addition to the removal of the powdered-iron slugs. The tap on L_1 is unimportant in this instance and may be neglected if desired by connecting the grid coupling capacitor directly to the hot end of the coil. The trimmers can be adjusted for optimum gain at 1430 kc., the output frequency of the converter, by using a broadcast signal as a source. Modification of the coils does not prevent the use of the BC-453 for other purposes at a later date since the coils come as a plug-in set and can be easily replaced with the original type.

If desired, the usual Command receiver modifications for phone jack, r.f. gain control, b.f.o. and a.v.c. switch, noise limiter, etc., can be made at the same time. The construction of a small 200–250 volt a.c. power supply with a separate inexpensive 26-volt filament transformer (Stancor P-6469) completes the unit. Voltages for the converter are obtained from the same power supply, of course, and B-plus should be dropped to 130–180 volts through a suitable resistor for optimum operation.

No special precautions need be observed in connecting the converter to the BC-453. In the interests of safety, however, it should be pointed out that at least one variety of commercially available "plug-in" power supply for Command receivers should be used with extreme care since if the line cord is plugged in backwards the receiver cabinet will become hot to ground. Severe shock or death might result if a grounded lead and the receiver cabinet is touched at the same time! — *Ronald E. Delp, W6DAW*

BANDSPREADING THE BC-455

THIS modification to the popular 6–9.1 Mc. Command receiver should appeal to both old hands with surplus equipment and those newcomers who are using this receiver as a mainstay of their stations. The end result of about an hour's work on the BC-455 will double its bandspread so that the 40-meter band covers about 2½ inches of dial circumference compared with the original one inch it occupied.

First, take off the outer dust cover of the receiver and remove the cover over the tuning capacitor. In order to do this it will be necessary to remove two of the i.f. cans and several tubes unless a right angle screwdriver is available. This provides access to the two bolts on the cover of the plate that supports the 12K8 grid cap lead. Now remove all rotor plates from the capacitor except the right-hand three in each section (looking at the capacitor from the rear of the receiver). Replace the dust covers. The dial will now have to be recalibrated. First paint it completely with black enamel. Locate the 40-meter band with a transmitter, signal generator, or the 7.335-Mc. Canadian Observatory signal. The rest of the calibration is best done with a 100-kc. crystal calibrator that has been checked against WWV. The dial can be calibrated by scratching it at 100-kc. intervals. Commercial decal numbers will dress it up and give it a professional appearance.

— Hovey M. Cowles, W3JWZ

A PANADAPTER CONNECTION FOR THE 75A-4

I FOUND an easy way to connect a BC-1031C panadapter to my 75A-4 without the need for much more than lifting the cabinet lid. Connect the hot wire from the panadapter cable to the tube shield of the 6BA7 second mixer and ground the outer shield of the cable to the receiver chassis. When replacing the tube shield, push it down to within 1/32 of an inch from the tube base shield, but don't let it touch! This forms a concentric capacitor around the tube and provides sufficient coupling between the receiver and panadapter.

— Robert W. Westcott, W8DNY

HEADPHONE ADAPTOR FOR CONTEST OPERATING

HERE'S a gimmick that is useful during contest operating, especially on Field Day. The circuit is shown in Fig. 2-5. It allows two sets of headphones to be operated from one receiver; each channel has its own volume control.

The transformer can be a universal output transformer. The voice coil winding is connected to the low-impedance output terminals of the receiver and the phones are on the push-pull winding side. The potentiometers allow for level adjustment to suit the operator/logger. Value of the pots is not critical; the ones shown just happened to be in our junk box!

The unit can be wired into a small minibox for easy transportation to the Field-Day site.

— Jack Cox, WØKMV

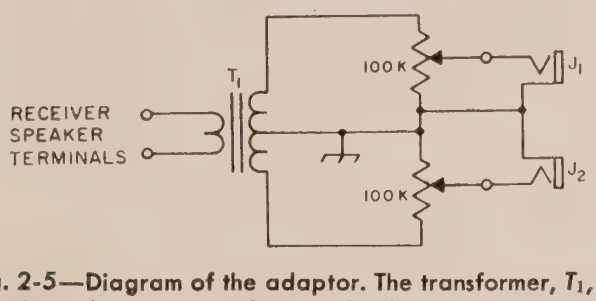


Fig. 2-5—Diagram of the adaptor. The transformer, T_1, is a universal output transformer. J_1, J_2, are phone jacks.

OUTBOARD B.F.O.

THE circuit shown in Fig. 2-6 is a simple 455-kc. b.f.o. which is easy to build and adjust. Most of the parts can be found in the junk box but if components do have to be purchased they can be obtained with no great damage to the billfold.

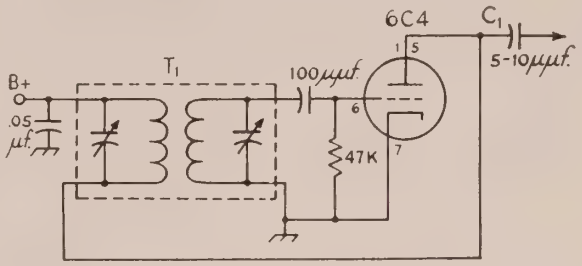


Fig. 2-6—Circuit of the b.f.o. Transformer T_1 is a 455 kc. i.f. transformer.

The circuit is a basic one and almost any triode may be used. The two coils and their capacitors are the two sections of a common 455-kc. i.f. transformer. If the b.f.o. is mounted near the receiver detector circuit no additional coupling may be required. However, the diagram shows a coupling capacitor C_1 which may be connected to the detector diode plate if additional coupling is required.

— James Lewis, K4SAM

NEW SHIELDING TRICK

RECENTLY we were bothered by a case of hum in a newly built receiver. It was suspected that more shielding would turn the trick, but we did not wish to remove half the components to make the necessary corrections. With an assist from the XYL the problem was quickly solved.

A piece of aluminum foil (the type used in cooking) was trimmed to the approximate size required and a length left attached for grounding. Then a piece of "Mystik" tape, a cloth-backed tape with excellent adhesive power, was attached to the foil and trimmed to size. A similar piece of tape, slightly larger, was attached to the other side of the foil and bent around the edges.

This shield could then be wrapped tightly around the components and leads in question and revealed in a few moments the source of the trouble. In fact, it worked so well that it was permanently attached. The tape has a tendency to "set" with time and makes an excellent shield.

— George P. Carpenter, W1TGV

AUDIO MUTING FOR THE COLLINS 75A-4

When the Collins 75A-4 receiver became available, many hams — particularly s.s.b. enthusiasts — were happy to find a provision for audio muting built into the receiver. The receiver has, in fact, provisions for two separate methods of receiver silencing. The first entails an "open the circuit while transmitting" means of biasing the r.f. amplifiers past cutoff. This method is quite satisfactory and requires no change in the average send-receive control circuit. However, the arrangement requires the application of positive 20 volts or more to the receiver's audio-muting circuit. Some hams have found existing sources of d.c. in their shacks for this purpose. The only charge necessary, then, was to change the contacts on the station's transmit-receive relay from "open" to "close" while transmitting. This is necessary because the 20 volts has to be applied to the receiver during transmitting periods. Others were forced either to build a suitable power supply or drag out a number of dry cells. Both of these alternatives, unfortunately, leave something to be desired.

In looking for another suitable arrangement, I found that the 75A-4 could provide the 20 volts d.c. needed for the audio-muting circuit and, also, retain the "open the circuit while transmiting" feature. At first, I simply opened the cathode-to-ground connection on the audio-output tube. However, to keep the pops caused by switching to a minimum, it was necessary to connect a filter capacitor across this circuit. This, in turn, brought up another problem. When the receiver's audio gain was turned up past the midpoint, modulation peaks blasted through with a monkey-talk quality (probably caused by leakage in the filter capacitor).

In any event, the voltage appearing across the capacitor while the silencing circuit was in the transmit position measured 21 volts. It was necessary only to run a jumper between this source and the regular audio-muting circuit and the problem was solved.

In case anyone should like to use this simple built-in power supply to silence their own 75A-4's audio, here is a step-by-step description of the modification.

1) For purposes of orientation, place the receiver, upside down, with the front panel toward you. Locate R_{98} and disconnect the wire that comes from the panel wiring harness and connects to the left (ungrounded) side of that resistor. Run a bare wire jumper between the terminal you just removed the wire from (the left terminal) and the ground terminal on the same strip (third terminal from the left). This disconnects the r.f. gain silencing circuit and leaves it in the "on" position.

2) Now locate the socket for the audio output tube, V_{22}, right below the terminal strip, and disconnect the bare wire running from Pins 2 and 3 to the ground lug on the terminal strip. Run a new wire between Pin 3 of the tube socket and ground. Then connect the free wire you originally disconnected from R_{98} to Pin 2 of the tube socket. Solder all these new connections.

3) Locate the "muting" terminal strip on the rear of the receiver. Connect a 10-μf. 150-volt capacitor between Terminals 2 and G, the positive end of the capacitor on Terminal 2. Now connect a jumper wire between Terminals 2 and M for the final step in the modification.

The receiver will now mute completely when no connection exists between Terminals 1 and 2 of the muting strip. Thus the normal "open while transmitting" breed of control circuit will perform nicely. Just connect this circuit to Terminals 1 and 2, and you are in business. (Note: If one side of your control circuit happens to be grounded, be sure to connect that side to Terminal 1).

One more thing. In the more recent 75A-4 receivers, a small subchassis has been added near the socket for V_{22}. This chassis mounts the potentiometers for S-meter zero and scale adjustment. In order to get at the terminal strip and audio output tube socket, it is necessary to remove the two chassis mounting screws and flop the chassis out of the way. Have no fears about moving the chassis, but be sure to remount it when the modification is completed.

Finally, operate the receiver with the combination power switch in the "standby" position. Otherwise, the silencing circuit will be bypassed and the receiver will remain on all the time. — *Lawrance H. Mitchell, W7BAS*

REMEDY FOR NOISY VOLUME CONTROLS

The following scheme has been used for several years to advantage, for quieting noisy volume controls. First make up a cleaning solution using a small dab of plain unmedicated Vaseline and a small amount of lighter fluid, naphtha, or any noncorrosive solvent that is quite volatile under normal conditions. Dissolve the Vaseline in the solvent in a warm place. Make up a batch of it and keep it in a stoppered bottle.

To cure the noisy volume control, remove the volume control knob, dip a pipe cleaner into the cleaning solution, and apply to the control shaft while turning the shaft back and forth with your fingers. A few applications for about one minute should be enough to return the control to normal again. Remember, if you use an inflammable solvent, keep fire and sparks away from it. If used on a plugged in receiver or other equipment connected to the a.c. line, pull the plug out first. The cleaning solution is both a cleaner and a lubricant and is not messy. It will penetrate small spaces, the solvent will evaporate and the lubricant will remain.

— *G. Roger Gladding, W1AOS*

USING THE NC-300 ON MARS FREQUENCIES

The 80-meter range of the NC-300 may be lowered to receive some of the MARS frequencies by connecting a "two-bit" capacitor in

parallel with the high-frequency oscillator section (front end of the gang) of the ganged variable.

The capacitor is made with a length of bare solid hookup wire, a coin and a layer of Scotch tape. Solder the wire to the free lug on the oscillator tuning capacitor, and then bend as shown in Fig. 2-7. The coin must make good contact

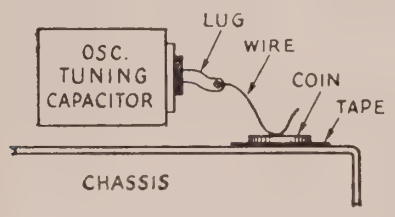


Fig. 2-7—Sketch showing the "two-bit" capacitor connected in parallel with the oscillator tuning of a type NC-300 receiver.

with the wire *spring*, and must be completely insulated from the chassis by the tape. A 25-cent piece will lower the receiver tuning range to include the MARS frequency at 3250 kc.

— Capt. J. R. Hagen, K4JMA

—•••—

If you want to include a MARS frequency — say, 4025 kc. — in the 80-meter tuning range of a National NC-300 try the following:

Using a pair of tin snips or good quality side cutters, cut about one sixteenth of an inch from the dial stop on the ganged tuning capacitor. Then, with the aid of long-nose pliers, bend the tab until it breaks off. Now, you have extended the tuning range of the receiver without harming its resale value.

Just be sure not to cut too much off the dial stop. Otherwise, you may run the dial pointer off scale and down the side of the receiver!

— Leonard M. Norman, W5CIN

IMPEDANCE MATCH FOR THE SIMPLE SHUNT CLIPPER

Although a single-tube circuit can be used for noise clipping during c.w. reception, it is not usually an especially effective arrangement unless the receiver output circuit is designed for a high-impedance load. In other words, the average one-tube clipper does not work too well when

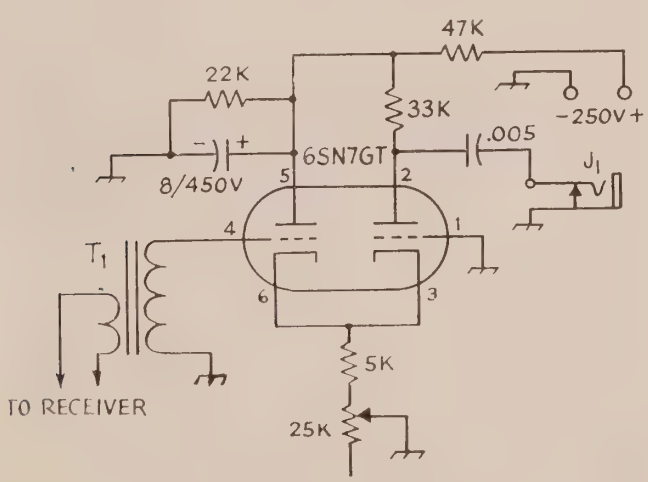


Fig. 2-8—Circuit diagram of the one-tube clipper. T_1 is an inexpensive b.c. receiver output transformer used for impedance matching.

plugged into the output jack of a receiver designed for low-impedance phones.

This problem can be easily overcome without expense by using a cheap or salvaged broadcast-receiver output transformer at the input of the clipper. The transformer, reverse connected as shown in Fig. 2-8, will provide a better impedance match for the grid of the clipper tube, thereby increasing the input signal and the clipping action. Use of a variable cathode resistor as shown permits adjustment of the audio volume and the clipping level. The rest of the circuit is quite similar to the clipper arrangement described in chapter five of *The Radio Amateur's Handbook*.

— Otto Woolley, WØSGG

SIMPLE HIGH-PASS FILTER FOR 28-MC. CONVERTERS

The simple high-pass filter circuit shown in Fig. 2-9 has a cut-off frequency of approximately 10 Mc. It is used to suppress b.c. signal feedthrough that frequently occurs when a

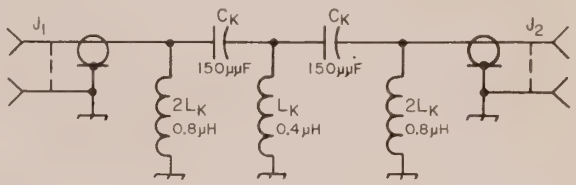


Fig. 2-9—Circuit diagram of the high-pass filter suggested by W1DBM.
L_K—0.4 μh.: 6 turns No. 20 enam. wire, ⅜-inch diam., 3/16 inch long.
$2L_K$—0.8 μh.: 11 turns No. 20 enam. wire, ⅜-inch diam., ⅜ inch long.
Note: Coils are self-supporting.

28-Mc. converter is worked into a low-frequency tunable i.f. such as a broadcast receiver. In one particular installation — c.d. layout described in *QST* for September, 1955 — the filter completely eliminates "birdies" which were encountered when using a ground-plane antenna and a long feed line. The filter was inserted between the antenna relay and the converter.

The housing for the filter may be made from either aluminum or flashing copper and should measure 2 by 2 by 4 inches. A box of this size allows inductors to be spaced apart enough to prevent coupling between coils.

Component values shown in Fig. 2-9 are for use with a 50-ohm antenna feed system. Values for a 75-ohm filter, or one having a cut-off frequency other than 10 Mc., may be quickly determined by employing the following formulas:

$$C_K = \frac{1}{4\pi fc}$$

$$L_K = \frac{1}{4\pi fcR}$$

where C_K = Capacitance in microfarads (μf.)
f = Cut-off frequency in megacycles (Mc.)
L_K — Inductance in microhenrys (μh.)
R_C = Termination resistance in ohms.

— P. S. Rand, W1DBM

SERVICE NOTES ON SOME HAMMARLUND RECEIVERS

When Hammarlund receivers type SP-100, SP-200, SP-400 and the surplus versions (BC-779, etc.) are operating properly, the maximum high-frequency oscillator drift is usually about 50 kc., and most of this takes place during the initial warm-up. The oscillator drift characteristics of these receivers can be materially improved by making a simple modification suggested by Jack Scheider of Hammarlund's Engineering Department.

First, obtain a 3.3-$\mu\mu$f. temperature compensating capacitor having the highest negative temperature coefficient available. Three 10-$\mu\mu$f. capacitors may be connected in series if the 3.3-$\mu\mu$f. job is not obtainable. Lift the top shield from the main tuning capacitor gang after removing the mounting screws from the top plate of the shield. Connect the 3.3.-$\mu\mu$f. capacitor between the stator terminal of the oscillator tuning capacitor (the first section away from the panel) and ground.

Realignment of the oscillator trimmers is the next operation. Turn the receiver upside down, panel facing toward you, and remove the bottom cover. Using a signal generator or the standard frequencies from WWV, adjust the trimmers for on-the-nose calibration of the test signals, The trimmer control shafts are accessible through the line of holes running from left to right across the shielded coil compartment. The line of holes directly to the rear of the panel are over the oscillator trimmers. *Do not* touch any of the other trimmers. All of the more popular receivers in the group referred to above have the high-frequency band trimmer at the left end of the line. Move on one step to the right each time the range of the receiver is decreased to the next lowest band.

Since the shunt capacitance which has been added to the circuit is only 3.3. $\mu\mu$f., it is obvious that each oscillator trimmer will require only slight adjustment. Only a fraction of a turn of each adjustment screw should be necessary.

Everyone who has made this modification to his receiver reports complete satisfaction. One report stated that the drift had been reduced to less than 200 cycles, and another claimed that the modified set was *excellent* for s.s.b. reception.

Audio-Limiter Alterations

The following is a step-by-step procedure for improving the action of the noise limiter for the aforementioned receivers. If you have the bottom plate off the receiver because of the oscillator modification, now is a good time to go to work on the limiter.

Audio-Circuit Changes

Operations 1 through 5 involve the first-audio tube socket.

1) Remove .02-μf. coupling capacitor feeding grid of first-audio tube. Replace capacitor with a jumper.

2) Remove grid-leak resistor from grid pin.

3) Remove ground connection from Pin 8.

4) Remove lead from 3-volt bias to Pin 6.

5) Connect a 100-ohm ½-watt resistor between Pin 8 and ground.

Second Detector-Limiter Modifications

1) Disconnect all wiring to the second detector socket (6H6) except that terminated at Pins 1, 2 and 7.

2) Remove all components and wiring from the terminal strip adjacent to the 6H6 socket except heater leads on the last lug.

3) Remove *all* wiring from the 6N7 socket.

Note: Steps 4 through 8 to follow pertain to wiring of the 6H6 socket. Fig. 2-10 is a sketch of the socket and the new wiring.

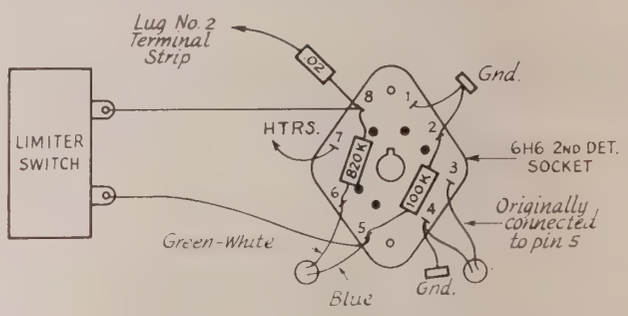


Fig. 2-10—Sketch of the layout for the second-detector socket (Hammarlund SP series receivers) after modification.

4) Connect the lead that originally went to Pin 5 to Pin 3.

5) Ground Pins 1, 2 and 4.

6) Connect the following to Pin 5: a lead to the limiter switch; a 100K ½-watt resistor to ground; the blue lead from the i.f. transformer.

7) Connect an 820K ½-watt resistor between Pins 6 and 8, and connect the green-white lead that originally went to the 6N7 grids to Pin 6.

8) Connect the .02-μf. coupling capacitor (see Step 1 of audio-circuit changes) from Pin 8 to Lug No. 2 of the terminal strip. Wire a lead between Pin 8 and the remaining terminal on the limiter switch.

9) Solder the audio input lead to Lug No. 2 on the terminal strip.

Do not attempt these modifications unless you feel that you are thoroughly capable of diving into a superheterodyne receiver. If you have any hesitancy about operating on your set, either forget the whole idea or pass the job along to someone who is familiar with what makes a superhet tick. — *Frank Lester, W2AMJ*

A TRANSISTORIZED TUNABLE CONVERTER

While it is perhaps cheaper to build a converter using tubes, it is very interesting to try the same project using transistors. The transistorized version can be used with a transistor car receiver with no power problems, and is small in size. The converter described here is designed for fifteen meters, mainly because ten meters is still hard to hit with inexpensive transistors, and the lower

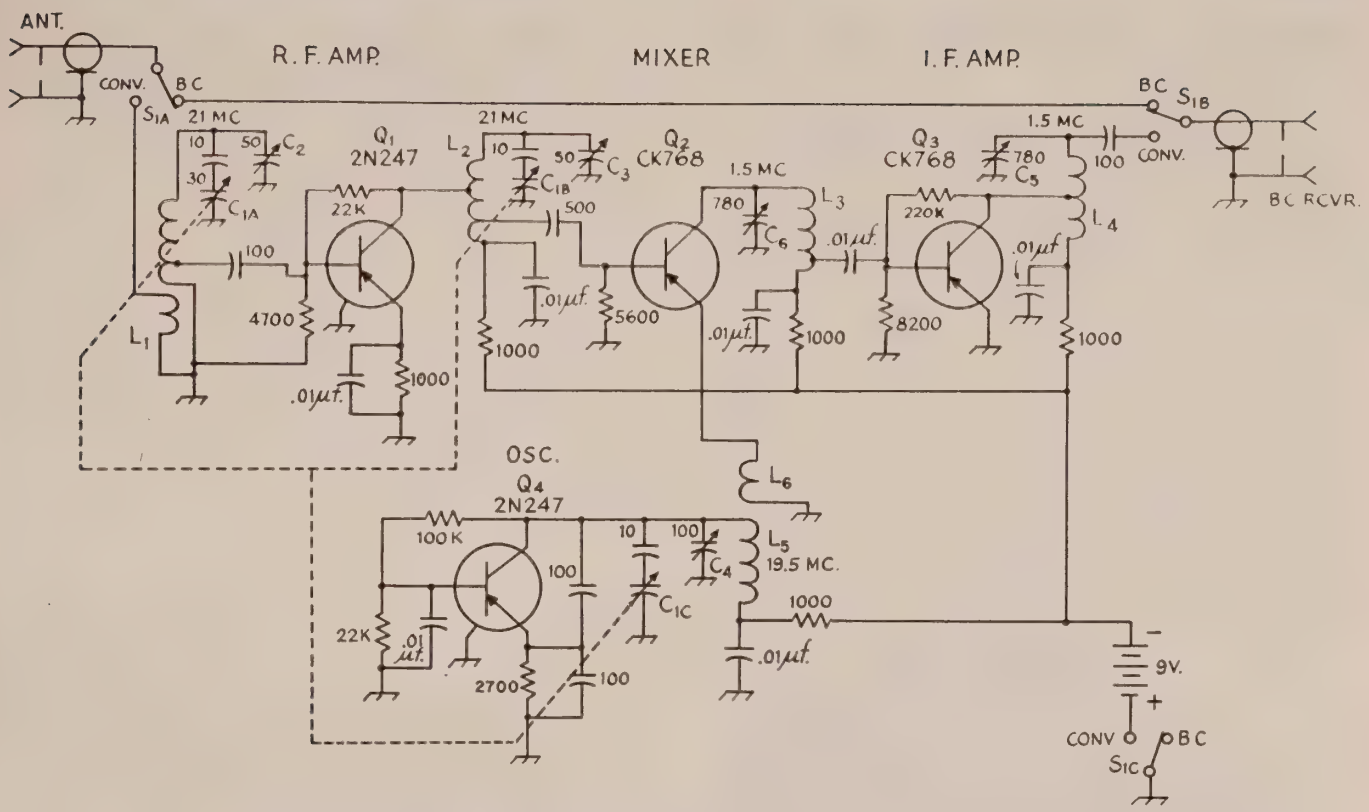


Fig. 2-11—Circuit of the transistorized tunable converter. Unless otherwise indicated, capacitances are in μμf. resistances are in ohms, resistors are ½ watt.

C_1—30-μμf. 3-section variable capacitor (three-ganged Cardwell type PL-6003 trim-air midgets).

C_2, C_3—50-μμf. air trimmer.

C_4—100-μμf. air trimmer.

C_5, C_6—780-μμf. mica trimmers.

L_1—9 turns No. 22 enam., ¼ inch long, ¾-inch diam., tapped 3 turns from cold end. Link is one turn No. 22 enam. wound near cold end of above coil.

L_2—12 turns No. 22 enam., ⅜ inch long, ½-inch diam., tapped at 2nd and 7th turn from cold end.

L_3, L_4—No. 32 enam. close-wound, ½-inch diam., 1 inch long, tapped 20 turns from cold end.

L_3, L_4—No. 32 enam. close-wound, ½-inch diam., 1 inch long, tapped 20 turns from cold end.

L_5—7 turns No. 22 enam., ½-inch diam., ¼ inch long.

L_6—4 turns No. 22 enam., close-wound ¼ inch above top of K_5.

S_1—3-pole 2-position rotary switch (Centralab PA-2007).

frequency bands have quite a bit of QRM. There is no reason, of course, why the converter could not be built for the other bands just by changing the coils.

The converter is of the tunable type with a fixed output frequency somewhere in the broadcast band (in this case, 1500 kc.). The ultimate performance obtainable from this type of converter is higher than from the fixed-frequency type because the front end need not be broadbanded. The converter is powered by a small 9-volt battery mounted inside the case, and since the total current drain is less than 3 ma., the battery should last for quite a while.

No particular constructional details are needed; the layout can be left up to the individual constructor.

The circuit used for the oscillator is a Colpitts. Stability was hard to come by when using a transistor at 19.5 Mc., but after many circuit modifications, the oscillator drift was cut down to about 5 kc. in a half hour from a cold start. It was found necessary to use a high-C circuit in the oscillator to get any usable stability at all, and the size of the base bias and emitter stabilizing resistors radically affected the performance of the oscillator, while changes in the base loading resistor did not have too much effect. One peculiar thing observed about the oscillator was its extreme sensitivity to temperature changes; heat from a quick touch of a soldering iron would send it drifting many kc. It was found that the oscillator could be made to drift noticeably by simply blowing on it. In the finished converter, every effort was made to keep the temperature stable.

The mixer operated best with absolutely no bias at all, which is not too surprising since that must be its most nonlinear condition. By vacuum tube standards, a lot of local oscillator injection was required. Several methods of injecting the signal were tried, but the method shown here reduced the "pulling" of the local oscillator when tuning the mixer to a minimum.

The r.f. amplifier is straightforward, with the size of the bias resistor being the most critical item. The base had to be coupled near the bottom of the coil before the base tuned circuit would have any selectivity at all. This tuned circuit was very easily loaded by the antenna, and one turn in the primary seemed to give maximum signal transfer and front-end selectivity.

The i.f. stage was thrown in as an afterthought, since an old automobile broadcast set was used. However, the converter had gain to spare, so there was probably to real need for this stage. The method of coupling this stage to the car receiver was determined purely by experimentation, and may require a little modification with other types of receivers.

— H. A. Ross-Clunis, jr., W6GRZ

PRODUCT DETECTOR FOR COMMAND RECEIVERS

A SIMPLE and inexpensive adaptation of the product detector[1] to the popular Q5-er (BC-453) is used here at W4JJX. The performance of this combination, used in conjunction with a type NC-183, is most gratifying. Fortunately, the detector circuit may be built into the Command set without necessitating any socket-hole punching or outboard construction.

The circuit of the detector and the method of connecting it to the BC-453 are shown in Fig. 2-12. The detector circuit is identical to the one described by Crosby except that type 6SN7GT tubes are used instead of the miniature type 12AU7. This modification does not require any changes in the component values used in the original detector, but it does permit taking advantage of the octal sockets already mounted

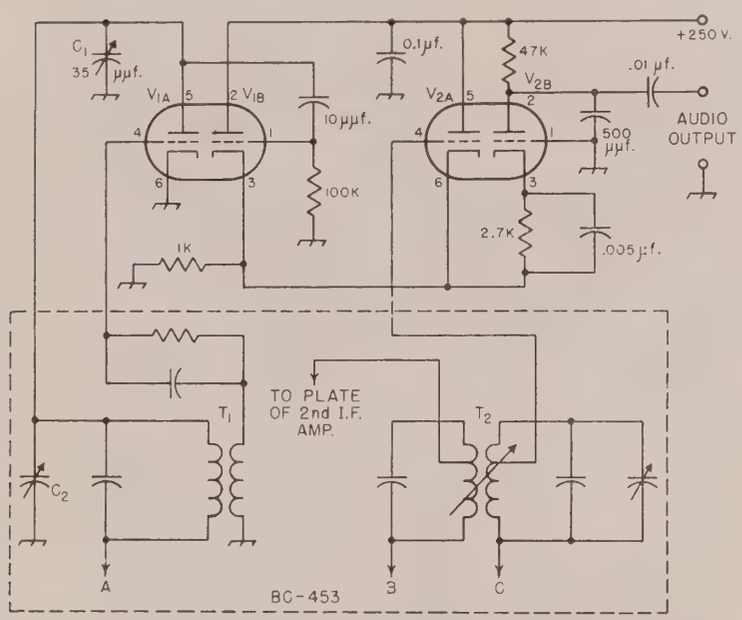


Fig. 2-12—Circuit diagram of the product detector as connected to a type BC-453 receiver. All resistors ½ watt. Components inside dotted lines are parts of the BC-453. Arrows A, B and C point to receiver wiring that need not be disturbed. T_1 and T_2 are the BC-453 b.f.o. and i.f. output transformers, respectively. C_2 is the original b.f.o. control and C_1 is a b.f.o. control mounted on the panel (see text). V_1 and V_2 are type 6SN7GTs.

in the Q5-er. In Fig. 2-12, V_{1A} is the b.f.o. tube for the BC-453 (the original tube for the b.f.o. circuit having been removed) and V_{1B} and V_2 operate in a triple-triode product detector circuit. Since the b.f.o. frequency of the Command receiver is screwdriver adjusted, the original control (C_2) was set at minimum capacitance and a new capacitor (C_1) having an external control knob was installed. This provides a convenient means of adjusting the b.f.o. to center frequency to furnish carrier for an s.s.b. signal.

Modifications which must be made to the Q5-er are the substitution of 6-volt equivalents for the r.f., i.f. and mixer tubes. Naturally, this will require rewiring of the heater circuit. The types 12A6 and 12SR7 used in the audio output and b.f.o. — second detector circuits, respectively, are not replaced with 6-volt equivalents, but the sockets for these tubes are used for the 6SN7GTs of the new b.f.o.-detector arrangement.

When clearing the wiring from these two sockets, do not clip short the leads to the b.f.o. circuit and the secondary of the output i.f. transformer as these will be reused as indicated in Fig. 2-12. Also, while working with the BC-453, adjust the b.f.o. control for minimum capacitance.If you don't care to open up the b.f.o. can so that the minimum-capacitance setting may be readily determined at this time, the adjustment can be made after the externally-controlled capacitor has been mounted and the complete receiving system has been placed in operation. In the latter case, set the new control at minimum capacitance and make a normal adjustment with the original control. Then, simultaneously increase and decrease the capacitance of C_1 and C_2, respectively, until the b.f.o. oscillator is *walked* back onto frequency.

The fiber adjustment rods for the three i.f. transformers (BC-453) should be pulled full *upward*. The i.f. passband is so narrow under this condition that intelligibility suffers when the BC-453 is used as a Q5-er for the reception of a.m. signals. It is therefore obvious that when an s.s.b. signal using either the upper or the lower sideband is tuned into the center of the BC-453 i.f. passband, and the b.f.o. is adjusted to the proper side of the signal, the operator has a *built-in* band-pass filter that is fair if not excellent.

When using this system for the reception of single-sideband transmissions, first tune the desired signal for maximum deflection of the receiver's S meter with the BC-453 *out* of the circuit. The BC-453 is then switched into the circuit and is tuned back and forth through the receiver i.f. passband until maximum audio is heard. Then the b.f.o. frequency is adjusted until the received signal sounds natural. Now the receiver a.v.c. is turned off.

After the preceding adjustments have been made, signals using the same sideband can be tuned in with the tuning control of the main receiver without the necessity of going through the above procedure.

Naturally, this setup will not compete with the upper-bracket gold-plated receivers on the market, but for the few dollars it costs, it gives surprisingly good results.

— Charles McDowell, W4JJX

A SIMPLE CONELRAD ALARM CIRCUIT

A SIMPLE visual-type indicator circuit for conelrad monitoring is shown in Fig. 2-13. The arrangement permits full compliance with conelrad regulations as they affect radio amateurs, and can be installed in a few minutes at a cost of less than $1.00. The indicators, ordinary pilot lamps identified in Fig. 2-13 as I_1 and I_2, flash brightly on audio peaks developed by an a.c.-d.c.

[1] Crosby, "Reception with Product Detectors," *QST* May, 1956.

receiver tuned to a modulated broadcast carrier. Inasmuch as most broadcast carriers are almost constantly modulated, the indicators glow without appreciable interruption as long as the broadcast station continues normal operation. When the lamps go out, it is an indication that the station has ceased operation for one reason or another, or that either the receiver or lamps have failed.

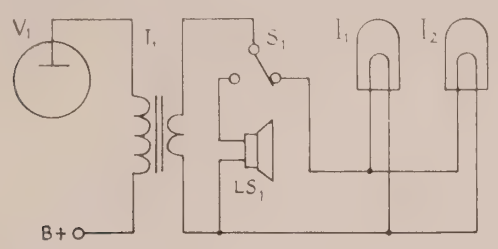


Fig. 2-13—Circuit diagram of the W3BFO conelrad monitor. The alarm components—two pilot lamps and a toggle switch—may be built into an a.c.-d.c. broadcast receiver or they may be mounted in a small box as illustrated in Fig. 2-14.

In Fig. 2-14, LS_1, T_1 and V_1 are the loudspeaker, audio output transformer and output tube, respectively, of a small a.c.-d.c. broadcast receiver. S_1 is a s.p.d.t. toggle switch which transfers audio voltage developed across the output winding of T_1 to either the speaker or the indicator lamps, I_1 and I_2. Thus, while the receiver is being used as a conelrad monitor, the speaker may be silenced to prevent annoying background noise. I_1 and I_2 are standard 6.3-volt 150-ma. (No. 40 or 47 will do) pilot lamps. Using two or more lamps connected in parallel (I use 3 lamps here at W3BFO) reduces the possibility of a *false* alarm that could be caused by lamp burnout in a single lamp arrangement.

Unless the broadcast signal is extremely weak, the lamps will glow quite brightly after the receiver has been tuned, S_1 thrown to the monitor position and the audio gain control advanced to the full-on setting. Remember to back off on the gain control before returning S_1 to the speaker position; otherwise you'll hear a most unpleasing blast of radio.

The lamps and the switch may be mounted in a small box located in some convenient spot at the operating position. Ordinary hookup wire may be used for the leads between the indicator unit and the control receiver.

— Harry T. Ebner, W3BFO

Editor's Note: Shortly after W3BFO submitted his conelrad alarm circuit, Earl W. Douglas, W9BBG, forwarded his ideas on the same stunt. However, Doug uses a small Christmas tree lamp as the visual indicator and points out an additional feature of the simple alarm. The bulb or lamp *flashes* when activated by the audio peaks derived from a broadcast carrier modulated by music, voice or other forms of entertainment. However, the lamp glows brightly *without* flashing when the 1000-cycle conelrad signal is being transmitted. In other words, the simple visual indicator actually differentiates between normal broadcast programming and conelrad alert signals.

A SIMPLE HOUSING

The simple conelrad monitor by W3BFO — and his comment about a small housing for same — made us think immediately about one of the most readily available (especially if you have any junior ops in the house) and inexpensive metal boxes that we know of — the containers used to package adhesive bandages. These small boxes can be drilled or punched with ease, soldered to without difficulty, have a hinged cover, and come in at least two different sizes.

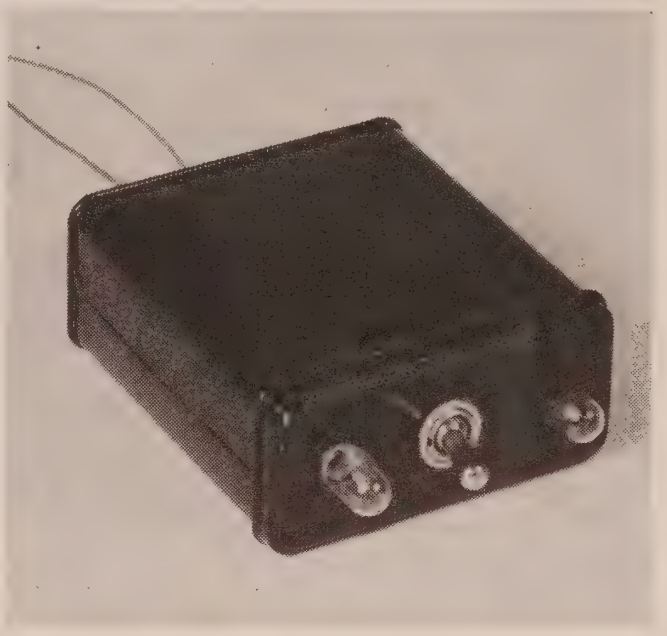


Fig. 2-14—The pilot lamps and toggle switch for a W3BFO-type conelrad monitor may be mounted on the lid of an adhesive bandage container as seen in this view.

The three alarm components, I_1, I_2 and S_1 of Fig. 2-13, can be mounted on the hinged lid of a box as shown in Fig. 2-14. Remove the enamel from the inside surface of the lid so that the lamps, after being twisted into snug-fitting mounting holes, can be tacked securely in place with a spot or two of solder. Punch or drill a hole in the bottom of the can (this surface is actually the rear of the box when the unit rests as shown in the photograph) to clear the three leads that must run to the speaker and the output transformer at the receiver end. The finished job takes on a neat appearance if the box is painted with a coat or two of enamel.

Incidentally, if you are building one of the alarms for use in a weak-signal area, it may be advisable to use the No. 48 or 49 lamps rated at 2 volts and 60 ma. It takes much less signal input to the receiver to light 60-ma. bulbs to full brilliance than it does to really brighten up the 150-ma. jobs. If there is doubt as to the best type of lamp for your own particular installation, use a v.t.v.m. to measure the audio voltage — audio gain control full on and speaker disconnected — available at the secondary terminals of the output transformer. If the maximum output is less than 3.5 volts, use the 60-ma. bulbs.

— C. Vernon Chambers, W1JEQ

RECEIVER INPUT IMPEDANCE MATCHING

After purchasing a new t.r. switch I realized it would be a problem to couple the switch to the receiver, since the receiver has a 300-ohm input and the switch has a low-impedance output.

Several methods of solving the problem were considered. I thought of using transmitting-type balun coils, building a matching device, or using antenna coils from an old junk-box receiver. It suddenly dawned on me that TV front-end tuners use a pair of balun coils to match a balanced 300-ohm line to a low-impedance unbalanced line. After purchasing a pair of these coils from a surplus store I installed them between the switch and receiver and found an increase in signal strength of at least two S units over the previously mismatched condition.

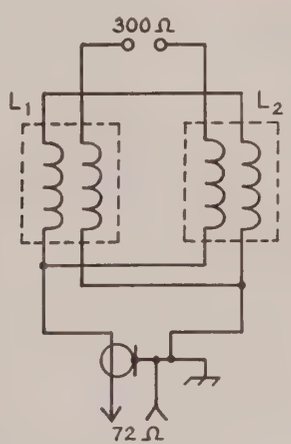


Fig. 2-15—Diagram showing connections when using TV front-end baluns for receiver impedance matching. L_1L_2—TV front-end balun coils.

These balun coils are available from most surplus stores and measure about $\frac{3}{8} \times 1\frac{1}{2}$ inches. They are bifilar-wound, one being a dark color and the other shiny in appearance. Close examination will identify the proper leads or an ohmmeter can be used to find the correct leads. The diagram in Fig. 2-15 shows the proper connections. —*Clark A. Chamberlain, W5RSH*

[The table below shows measured impedance at the 72 ohm side with a 330-ohm resistive load connected to the 300-ohm terminals. — *Ed.*]

Frequency (Mc.)	Input Resistance (ohms)	Equivalent Shunt Capacity ($\mu\mu$f.)*
7	100	− 86.5
14	90	− .1
21	80	+ 10.4
28	70	+ 10.5
30	68	+ 10.4
50	50	+ 4.5
100	109	− 4.0
145	53	+ 2.5
220	160	− 1.5

* Shunt capacitance required to be added (−) or subtracted (+) to resonate the circuit at the given frequency.

VISUAL INDICATOR FOR CONELRAD MONITORING

Anyone interested in gadgets in order to comply with the conelrad rules may be interested in the simple visual alarm used here at W7UWO.

The indicator circuit, shown here as Fig. 2-16, is the familiar electron-ray indicator arrangement described in recent editions of *The Radio Amateur's Handbook* (Signal Strength and Tuning-Indicators Section). It uses a type 1629 electron-ray tube which, incidentally, was lifted from a Command transmitter that had been assigned to the junk box. A small five-tube a.c.-d.c. broadcast receiver provides the control voltage (a.g.c.) and the power for the plate, target and heater elements of the tube. The filament of the 1629 is connected in series with the heater line of the broadcast receiver. This results in slightly reduced heater voltage on all of the tubes, but this appears to have no adverse effect on the operation of the receiver or the indicator tube. Remember to return the B — lead of Fig. 2-16 to the *common* ground in the broadcast receiver — not to the receiver's chassis or the bracket that supports the tube. This method of installation will eliminate shock hazard.

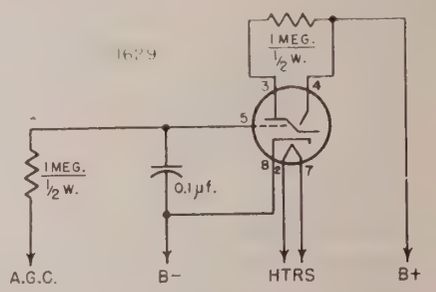


Fig. 2-16—W7UWO uses this circuit as a conelrad alarm. The visual indicator is a type 1629 removed from a surplus Command transmitter.

The 1629 may be conveniently located at the operating position. The *eye* of the tube will remain closed as long as the receiver is tuned to a broadcast signal. When the eye opens, it is time to cease transmitting and then retune the receiver to one of the two conelrad frequencies — either 640 or 1240 kc.

This simple indicator works quite well in actual practice and about the only cost involved was a little time on my part.

—*Charles A. Lofgren, W7UWO*

AUDIBLE CONELRAD WARNING

The circuit shown in Fig. 2-17 provides conelrad monitoring by mixing the output of a broadcast receiver with that of a ham-band communications receiver. The "background" signal caused by the broadcast audio will provide continuous monitoring as long as both receivers — and a broadcast station — are in operation. Amplitude of the background or warning level may be controlled by the volume control for the broadcast receiver. Although the system is simpler and less expensive than most of the a.v.c. triggered arrangements, it may be used with any broadcast signal that *can be heard*. And in most cases, signals that can *just be heard* are ones having insufficient strength to operate reliably an a.v.c. controlled alarm.

LS, T_1 and V_1 in Fig. 2-17 are the loud-speaker, output transformer and audio-output tube, respectively, of a small broadcast receiver. T_2

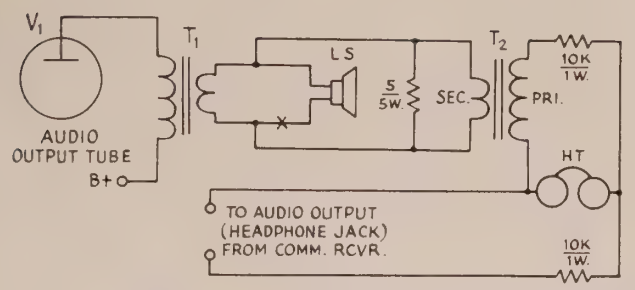


Fig. 2-17—Circuit of the audible conelrad monitoring arrangement submitted by WA2ANU.

is a transformer of either the filament or output type and must be connected with the secondary winding in parallel with the low-impedance side of T_1. The values of resistance shown in the schematic work well with headphones of 2000- to 8000-ohm impedance.

A s.p.s.t. toggle switch may be inserted at point X to disable the broadcast receiver loudspeaker if desirable.

— *David T. Geiser, WA2ANU*

USING THE GRID DIPPER AS A CONELRAD MONITOR

HERE is another conelrad idea that puts a piece of test gear to work almost "full time." I've been using my B & W grid dipper as an audible/visual conelrad monitor and find that it works quite satisfactorily when tuned to a local broadcast carrier of reasonable strength.

The only work involved in preparing the meter for conelrad operation is the winding of a broadcast-band coil. The tuning range of the meter is not wide enough to cover the complete band, but will cover better than 700 kc. with one swing of the main-tuning dial. An inductor of fair size — both in value and physical shape — is required. A form similar to the now obsolete National type XR-6, having a diameter and winding length of 1½ and 2¼ inches, respectively, is ideal for the job after all but two of the prongs have been removed.

The inductor-meter combination used here at W2TJX rides the local 1210-kc. channel for continuous monitoring. It takes only a second to slide up to the 1240-kc. conelrad frquency whenever the shift is warranted.

— *Wilbur C. Stevens, W2TJX*

[To assist anyone who wishes to try W2TJX's idea, we made some capacitance checks on Barker & Williamson, Heathkit and Millen grid-dip meters. Approximate values of minimum and maximum tuning capacitances for the three meters tested are as follows:

Type	Min. μμf.	Max. μμf.
B & W 1600	6	55
Heathkit GD-1B	8	75
Millen 90651	7	50

From the above, and with the aid of an ARRL Type a *Lightning Calculator*, it is a simple matter to determine that any one of the three meters will cover the 700- to 1600-kc. range with a 1-mh. inductor in use. And a few seconds more with the *Calculator* shows that the 1-mh. coil may be made with 215 turns of No. 32 enameled wire, close-wound to a length of 1⅞ inches on a 1½-inch diameter form. — *Ed.*]

WARNING — A.C.-D.C. RECEIVERS AND CONELRAD MONITORS

AS is the case with almost any piece of a.c.-d.c. equipment, there is always the possibility of *shock* hazard when you start adding outboard leads and devices to an a.c.-d.c. broadcast receiver. Therefore, before installing a conelrad alarm such as described by W3BFO (see pages 36 and 37) it is a good idea to check and rewire, if necessary, the output-transformer and speaker wiring of the set. Make sure that the transformer-to-speaker wiring is clear of the chassis. Then, if random insertion of the line plug or failure of the isolating capacitor places the chassis *above* ground, the a.c. line voltage to the receiver will not be transferred to external leads, exposed terminals or alarm-circuit components.

— *Kermit A. Slobb, W9YMZ*

CONELRAD MONITORING WITH DISCARDED AUTO RECEIVERS

AUTOMOBILE receivers of the 6-volt vibrator type — as well as 12-volt models if your junk box happens to be that modern — that have been set aside for one reason or another can be put to work as fixed-station conelrad monitors by modifying them for a.c. operation. Only a few minutes labor is involved in the transformation, and if the junk box does not contain the main component required a brand-new one will cost much less than the price of an all-new monitor.

The first step in modifying the car receiver is that of removing the vibrator and locating the primary winding of the power transformer. This is usually a center-tapped winding having the outer ends connected to the vibrator socket and the c.t. connected to the d.c. input (battery) terminal. Next, connect the secondary of a 6.3-volt filament transformer between the c.t. and one end of the vibrator transformer primary winding, and then ground one side of this circuit to the chassis. Now, install a 115-volt a.c. line cord for the filament transformer. The on-off switch on the receiver can probably be easily rewired to serve as the on-off control for a.c. operation.

Chances are better than average that the ends of the vibrator transformer primary winding will be terminated directly at the vibrator socket and that these leads need not be disconnected from any other part of the power supply circuit when the above modification is made. However, it is advisable to make a thorough check of the circuit just in case. The resistor and capacitors that are usually connected across the primary winding need not be disconnected.

Naturally, it is advisable to determine how much current the radio normally takes from the car battery in order that you can estimate the required current rating for the filament transformer. If the fuse is still mounted in the receiver, it will give you a clue as to normal receiver power ratings.

— *Kendall Young, W5OCV*

3. Hints and Kinks . . .

for the Transmitter

"MAGIC EYE" TUNING INDICATOR

Occasionally the need arises for a really low-cost transmitter, one such as might be built and paid for by an individual and then left to sit at the local civil defense station. Here is a suggestion that will help cut the cost. The author makes no claim of originality of the idea because it has been used in both amateur and commercial designs.

The idea is that of using an inexpensive "magic eye" tube as the tuning indicator for the output stage of the transmitter. If you can not *steal* a type 6E5 from an old broadcast receiver, a new one won't cost much more than a dollar. Properly installed, this simple indicator will serve the purpose just as well as its more expensive counterpart, the customary plate milliammeter.

A typical installation is shown in Fig. 3-1. In this case, the power-amplifier tube is a type 2E26

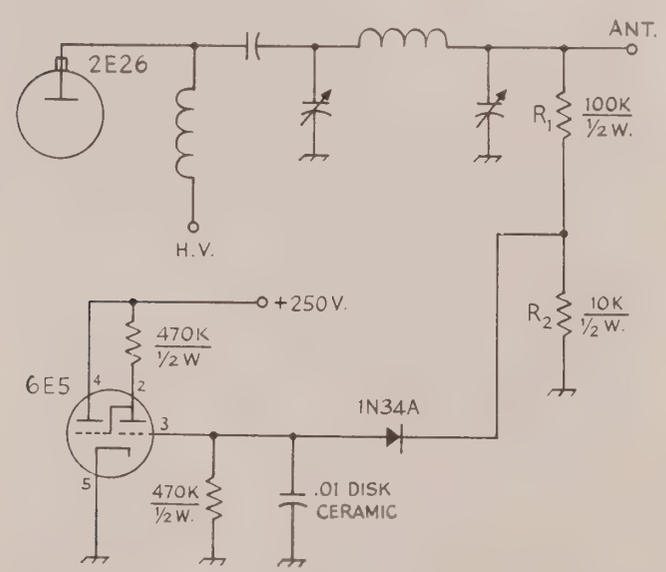


Fig. 3-1—Circuit of the "magic eye" tuning indicator as connected to W9KLJ's transmitter. Components without values are parts of the power-amplifier output circuit.

running at 16 watts input. For other values of power input, the resistance of R_2 can be altered from that shown. Indicator tubes other than the type 6E5 will require appropriate changes in both R_1 and R_2.

— John W. Wilder, W9KLJ

PROTECTION OF TETRODE SCREEN GRIDS

One of the disadvantages of using a fixed screen supply is the excessive screen dissipation that occurs when plate voltage is unintentionally removed from the tube. This drawback of the fixed-supply system can be overcome by feeding the screen through the contacts of a normally open s.p.s.t. relay as shown in Fig. 3-2. Voltage for the relay is obtained from the

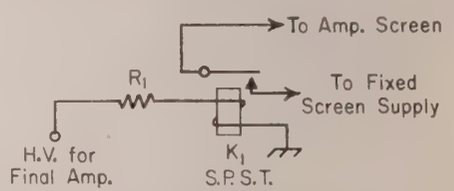


Fig. 3-2—Protective circuit for fixed screen-supply operation.

high-voltage plate supply through the dropping resistor, R_1. The value of resistance and the wattage rating of R_1 will be determined, using Ohm's Law, by the resistance of the relay winding and by the output voltage of the h.v. supply.

The most desirable feature of the system is that it is automatic. If the plate voltage is removed from the tube because of a blown fuse, defective component or the unintentional opening of a control switch, the relay opens and breaks the screen voltage lead.

— Don Priebe, W8MQQ

OSCILLATOR MODIFICATION FOR THE "GLOBE SCOUT" TRANSMITTER

The 6V6 oscillator tube in the W.R.L. "Globe Scout" transmitter requires more drive than some of the small v.f.o. units will deliver. This condition can be quickly remedied by changing the oscillator tube to a 6AG7, as suggested to me by W1DJC. The oscillator tube socket must be rewired to accommodate the new tube, but it is not necessary to after the basic circuit.

After the modification, the transmitter can be driven by a small v.f.o. such as the Heathkit VF-1, and will work as well with crystal control as it did before.

— R. A. Laine, W1CDD

RE THE 4X150A

We have found that some 4X150As "go west" due to a short between control grid and screen grid. If a d.c. potential of 1800 to 2000 volts is impressed across these grids, the short is vaporized, and in many cases, the tube is returned to operative condition.

Any good v.t.v.m. may be used to check the circuit to show the high-resistance short. Naturally, infinite resistance will appear between grids of a good tube.

— *Dwight B. Olson, W9EAM*

NEUTRALIZING CAPACITOR FOR SCREEN-GRID TUBES

A simple and inexpensive capacitor for the capacitive neutralizing circuit can be made from a war-surplus slug-tuned coil form and a strip of flashing copper. A ½-inch strip of copper wound around a ⅜-inch form having a ½-inch slug will provide a capacitance range of 0.6 to 10 $\mu\mu$f. This range of capacitance is ideal for tubes such as the types 2E26, 6L6, 829B, 6146, etc.

Of course, the coil form should be one having a brass slug.

— *Lloyd G. Hanson, W9YCB*

IMPROVED R.F. CABLING FOR REMOTE-TUNED VFOs

After constructing and using several remote-tuned variable-frequency oscillators, it became apparent that one of the weakest points in this system is the cabling between the frequency-control box and the rest of the oscillator. Instability or intermittent operation of a v.f.o. can frequently be traced to poor contacts in the plugs and receptacles used to terminate the interconnecting coax line. I have found that Amphenol type 83–22SP and 83–22R plugs and receptacles, respectively, used in conjunction with RG-22/U coaxial cable, provide the most reliable tank-to-tube connections yet employed.

— *Donald Miller W4VZQ*

CRYSTAL SOCKET HINT

An 8-prong tube socket wired as shown in Fig. 3-3 provides the maximum usable number of mounting positions for a crystal. With the socket

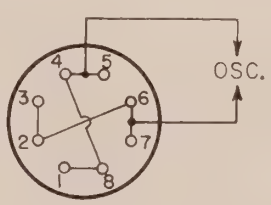


Fig. 3-3—A novel way of connecting an 8-prong socket for use as a crystal holder.

so connected, it is impossible to insert a crystal without making connection to the oscillator circuit.

Incidentally, the undersigned claims no credit for the idea. It's just one of those stunts that turned up in a technical article and then seemed to receive no further mention. Let's hope that some of the fellows will find it adaptable to their next rigs.

— *Joseph A. Unterkofler*

TRANSMITTER NEUTRALIZING WITH THE STATION RECEIVER

Recently, while neutralizing a new transmitter, I tried using the station receiver as a neutralizing indicator. High voltage was removed from the transmitter final-amplifier tubes and a short piece of coax was connected to the transmitter output. The coax was terminated with a wide-spaced two-turn coil about ⅝ inch in diameter. A one-turn coil of the same diameter was connected to a short piece of Twin-Lead which in turn was connected to the receiver's antenna input terminals. The receiver was then tuned to the transmitter frequency.

With drive applied to the transmitter final amplifier, adjust both the coupling between the above coils and also the receiver's r.f. gain control for maximum S-meter reading. To neutralize; adjust the neutralizing circuit in the transmitter for minimum S-meter reading.

— *Corwin Butler, K5INC*

CORRECTING WRONG-WAY GRID CURRENT IN THE HEATHKIT DX-100 AND APACHE TRANSMITTERS

Under certain conditions during tune-up the final grid current reading on both the DX-100 and Apache transmitters will go below zero. With the change shown in Fig. 3-4, the meters will read actual grid current without going below zero.

On the Apache, the change is easily made by shifting the yellow wire from terminal C1-2 to CJ-1, as shown in Pictorial 22, page 67 of the Apache instruction book. On the DX-100 it will be necessary to add an insulated terminal. Mount the terminal on the spade bolt that holds the v.f.o. bracket adjacent to the 500,000-ohm clamp-circuit potentiometer (see Pictorial 7, page 34 of the DX-100 instruction book).

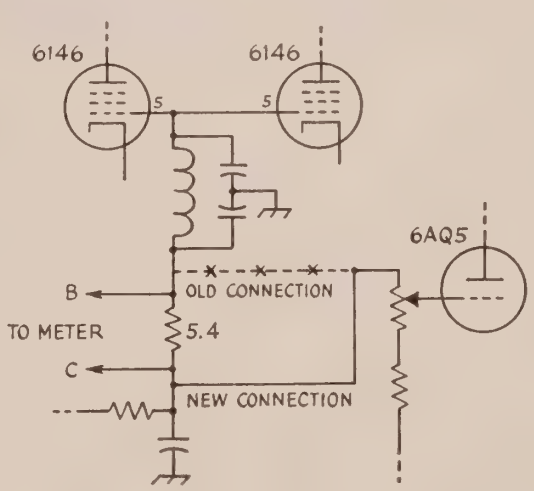


Fig. 3-4—New connection to improve the DX-100 and Apache meter circuit.

Remove the violet wire and the 5.4-ohm resistor from terminal 3 of the 500,000-ohm clamp circuit potentiometer. Reconnect these leads to the insulated terminal. Now connect the vacant potentiometer terminal (3) to the other side of the 5.4-ohm meter shunt.

— *Harold C. Jensen, W1LUW*

VIKING RANGER V.F.O. ZERO BUTTON

THE circuit shown in Fig. 3-5 was developed to permit zeroing the Viking Ranger v.f.o. without operating any switches after the transmitter is tuned up. Normally, in order to zero beat a received station, the OPERATE switch has to be turned from C.W. to STANDBY and the key pressed. This requires two switch operations each time the v.f.o. is tuned to the frequency of the received station. During a contest this might require hundreds of switch operations.

The zero button S_1 keys the v.f.o. independently

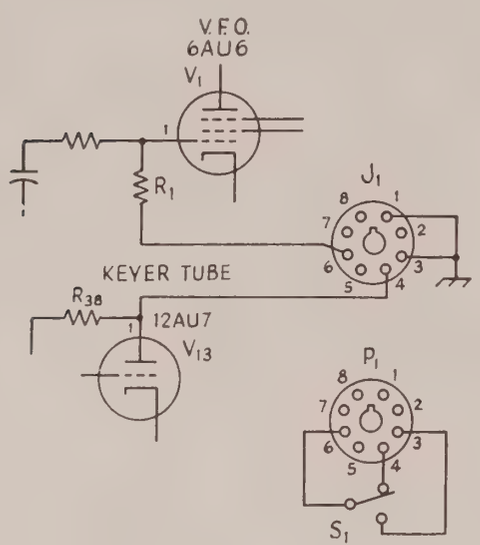


Fig. 3-5—Diagram showing the v.f.o. zero addition to the Viking Ranger.
J_1—Existing octal socket.
P_1—8-prong octal plug (Amphenol PM8-11).
S_1—S.p.d.t. push button switch (General Cement 1340).

of the rest of the transmitter. The level of the "v.f.o. only" signal in the receiver is adequate on 80 and 40 meters and reduced somewhat on 20 meters but still usable.

Unused pins on the existing octal socket J_1 (the one provided for plugging in crystals) are used to bring out the oscillator grid connections without the need for drilling any holes and destroying the resale value of the transmitter. An Amphenol octal type plug, P_1, is connected to the push button zero switch by a short length of cable and is mounted at the operating position. To restore the transmitter to its original circuitry, merely connect pins 4 and 6 of the crystal socket together. — *Lewis E. Elicker, jr., W3ADE*

KEEP IT CLEAN

USERS of forced air-cooled tubes such as the 4X150, 4CX250B, PL172, etc., should pay attention to the small print on the tube data sheet which says, "Clean the air system periodically." The blower blades in particular will pick up quite a bit of dust and lint which becomes packed between the blades, with the result that the output of air and the life of expensive tubes are reduced considerably. A pipe cleaner moistened in water is ideal for cleaning both the blower blades and the cooling fins of the tube. Cleaning should be done every two months.

— *Melvin Leibowitz, W3KET*

RELAY-CONTROLLED SEND-RECEIVE CIRCUIT

THE CIRCUIT shown in Fig. 3-6 was built into a small control box for use with a type BC-458-A transmitter. However, it may be used with any transmitter that uses a separate power supply for the oscillator.

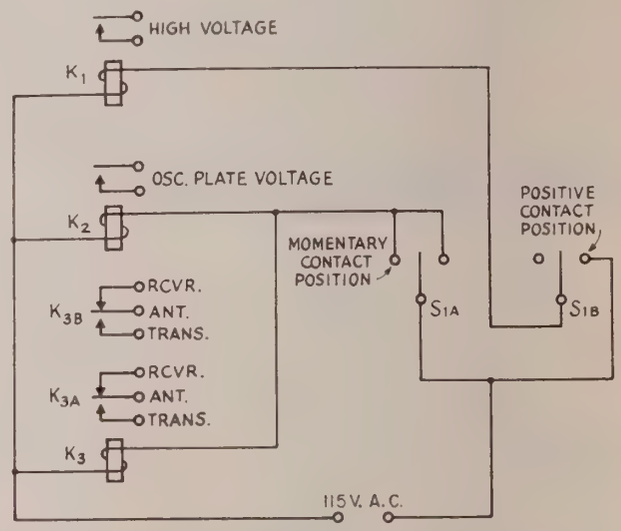


Fig. 3-6—WØYVA's send-receive circuit. K_1, K_2 and K_3 are 115-volt a.c. relays. S_1 is shown in the "receive" or neutral position.

In the arrangement, K_1 and K_2 are normally-open s.p.s.t. relays. K_3 is a normally-open d.p.d.t. antenna changeover relay. S_1 is a d.p.d.t. switch having a center-off position in addition to the momentary- and positive-contact positions. Of course, if this particular type of switch is unavailable, any d.p.d.t. switch having a neutral position will do the trick.

The circuit functions as follows: With S_1 in the "receive" or center position, all relays remain open and the contacts of K_3 connect the antenna to the receiver. For zero-beating or other adjustments involving only the oscillator section of the transmitter, S_1 is thrown to the momentary-contact position. This causes K_2 to apply plate voltage to the oscillator and K_3 to disconnect the antenna from the receiver. In the "transmit" or positive-contact position, S_1 feeds 115 volts a.c. to all three relays, thereby activating the entire transmitter.

— *Bob Sullivan, WØYVA*

CRYSTAL HOLDER HINT

ANYONE who does much crystal grinding probably has frequent occasion for dismantling surplus-type crystal holders. And it's probably just as true that the grinder has had his share of trouble keeping track of the small nuts and lock washers that fall free of the holder when the latter is opened.

There is a very simple solution to this problem. Merely cover the back side of the holder with a strip or two or Scotch tape. This prevents the nuts and washers from falling free and, of course, each piece of hardware will be right where it belongs when assembly time comes due.

— *Bert Felsburg, W3VN*

HI AND LO-BAND EDGE MARKERS FOR "COMMAND" TRANSMITTERS

SOME operators may be interested to know that the "resonance-indicator" circuit in the popular Command transmitters will work with two crystals. Therefore, it is possible to use the arrangement for marking both the upper and lower limits of a band.

The two crystals must be connected in parallel before being inserted in the original crystal holder. An adapter for a pair of FT-243 holders can easily be made by wiring an 8-prong octal socket to an 8-prong octal plug. The latter may very well be the base of an old tube. Prongs 1 and 7 of the socket should be connected to Pin 7 of the base, and socket prongs 3 and 5 to Pin 3 of the base. Remove the unused prongs from the socket to prevent shorting, and bind socket and base tightly together with friction tape.

The magic eye (1629) may not open as wide with the dual-crystal arrangement as it does when a single crystal is used, but it will give a positive indication of resonance as the v.f.o frequency slides onto either crystal frequency. The frequency of the oscillator may "pull" slightly toward the crystal frequencies, but this slight pull may even help so far as staying in the band is concerned. Of course, when using this system, one must first make very sure that the marker crystals are *within* the band.

— *Joseph W. Thane, KØGGL*

MODIFYING 1625s FOR GROUNDED-GRID OPERATION

IN *QST*, June, 1955, W9MOW and W9SAR called attention to the desirability of providing a direct ground for the beam-forming plates of the type 1625 when the tube is used in grounded-grid applications. Although the previous modification instructions work well in practice, there is a simple method of providing the separate ground that does not require removing the original base and replacing it with a 6-prong type. At least, the method under consideration can be applied to Ken-Rad (GE), Canadian GE, and some unknown brands that come in Sky-tron cartons.

To get *into* the base of a tube, support it horizontally in a cradle such as a vise with Pins 5 and 6 at the top. Then, use either a rat-tail file or a jeweler's saw to cut a slot in the base directly above Pins 5 and 6. Make the slot about ¼ inch wide and long enough to permit working around the two pins with a small tool such as a soldering aid. Now, apply heat from a soldering iron to the cathode pin, slip the beam-forming lead out of position, and insert it in Pin 5. Solder where needed, and the tube is ready for use.

— *Harry W. Land, W5ZBF*

Editor's Notes:

1) Capt. Jesse F. Adams, MC, USN, WA2EBW, also submitted the above hint for modifying type 1625s after he had picked the idea up from W6ESE. And he also reminds us that tubes made by National Union and Raytheon have the beam-forming lead brought out of the glass envelope (to Pin 6) where it is accessible after cutting into the base.

2) W. E. Howard, W8PWS, pulls the beam-forming and cathode leads *out* through a ¼-inch hole drilled in the side of the base in between Pins 5 and 6. The hole is centered ¼ inch above the bottom of the base and is drilled with care to prevent shattering of the glass stem at the center of the base. After the leads have been identified by means of an emission test, they are passed down over the *outside* of the base to Pins 5 and 6, and soldered. A few drops of Duco cement secure the leads to the side of the base.

3) Our own interest in modified 1625s led us down to the lab, the tube bin and then to the workbench. We not only found out that the above suggestions are indeed effective, but that the RCA 1625s — the ones we happen to have the most of — do not have the separate leads for the beam-forming and cathode elements. So here is one brand that there is no need for hacking into "just to find out."

USING THE MEISSNER TYPE EX SIGNAL SHIFTER AT 1.8 MC.

DURING the transatlantic tests on 1.8 Mc. last year I soon tired of my one crystal-controlled frequency. This condition was soon remedied by modifying the transmitter so as to permit using the Shifter as a source of 160-meter excitation. The method outlined below should work with any turret-type Meissner Signal Shifter and with many other types of exciters using doubler (to eighty meters) output stages.

The Signal Shifter here at W9PNE drives a bandswitching 809 buffer stage that is in turn followed by an 8005 final. A 365-$\mu\mu$f. variable capacitor was connected in parallel with the regular 100-$\mu\mu$f. job already in the 809 grid circuit. The 809 grid coil was then rewound so that it resonated at eighty meters with the 365- and 100-$\mu\mu$f. capacitors set for minimum and one-third capacitance, respectively. The tank circuit then tuned to 160 meters with the large capacitor nearly meshed. Several turns were added to the large 300-ohm coupling link which was wound directly over the grid coil at the grounded end.

With the Shifter tuned for output at 3.6 Mc. and the 809 grid circuit resonated at 1.8 Mc. the 809 gave more than enough drive to the 8005 amplifier running with 200 watts input at 1.8 Mc. High-C was used in the plate tank of the 809 to minimize 3.6-Mc. output.

There is nothing mysterious about this method of operation. The Signal Shifter uses a 6V6GT oscillator-doubler followed by an 807 doubler. In this case, use is made of the fact that most single-ended doubler stages do deliver appreciable output at the fundamental frequency. Furthermore, the 807 output stage has a low-C plate circuit and uses fairly tight output coupling. This combination closely coupled to the high-C input tank of the 809 results in adequate excitation for the tube at 1.8 Mc.

There has been found no tendency toward instability with this arrangement. Keying is excellent and the note is T9x with negligible drift. The output frequency of the exciter is exactly one-half of the normal output frequency for any setting of the Shifter dial.

— *Brice Anderson, W9PNE*

IMPROVED CONTROL CIRCUITS FOR THE DX-35

THE accompanying diagram, Fig. 3-7, shows how a d.p.s.t. toggle switch can be used to advantage in the send-receive circuit of a Heathkit type DX-35 transmitter. Once the simple modification involving mounting and wiring the switch is completed, it will provide *one-switch* control of the transmitter plate voltage and any external relays that may be used for antenna changeover, receiver muting, etc.

S_{1A} of the new arrangement provides on-off switching of 115 volts a.c. that has been piped over to previously unused terminals 5 and 6 of the auxiliary power socket. This voltage may be cabled out to the aforementioned relays. S_{1B} of the modified circuit is connected in series with the on-off contacts of the "Operation" switch for the transmitter. Thus, S_1 provides simultaneous control of the transmitter, the antenna relay, and the receiver muting circuit.

In making the modification, first remove the key jack from the front panel of the transmitter. Drill a hole in the rear apron of the chassis, in between the coaxial receptacle and the microphone jack, and remount the key jack. The hole left vacant at the front of the rig should now be enlarged slightly to accommodate the toggle switch, S_1.

Next, replace the lead between Terminal 6 of the operation switch and ground with a pair of leads which terminate at S_{1B} as shown in Fig. 3-7. The second wire originally connected to Terminal 6 of the operation switch (the one that goes to the slide switch) should be disconnected at Terminal 6 and then returned directly to ground.

Pin 11 or 12 of the operation switch is connected to the a.c. line cord at the 4-terminal tie-point strip identified as part "AA" on Heathkit pictorial drawings. Using an ohmmeter, or other means, determine which switch pin is so connected, and then run a wire from this pin to one terminal of S_{1A}. Connect the other side of S_{1A} to Pin 5 of the auxiliary power socket, and then connect Pin 6 of the socket to Terminal 1 of lug strip "AA." This completes the wiring except for adding by-pass capacitors, C_1 and C_2 in Fig. 3-7, to Pins 5 and 6 of the power socket. These capacitors should be similar to those already connected to other terminals of the auxiliary power socket.

The filaments of the transmitter are still turned on and off with the operation switch after S_1 has been installed. The operation switch is set at either the c.w. or the phone position depending on the mode of transmission and is not used again until the transmitter is turned off. Turning the toggle on will apply high voltage — with operation switch on either phone or c.w. — and will activate the external antenna or other relays.

— Reagin Warren, W4RVH

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WHEN using a v.f.o.–DX-35 setup it is necessary to have the carrier on the air when zeroing in on the desired frequency. This forces the operator to sweep the band with a carrier and causes receiver blocking. The number two fault is minor in comparison. It is just that in changing back and forth from send to receive, the usual combination of switches on the transmitter and receiver have to be operated quickly and in the proper direction and sequence. Both of these faults are easily corrected by a simple modification without impairing the operation or basic design of the set. In fact, with the modification in effect, a shorting loop shoved into Pins 5 and 6 of the auxiliary socket leaves the operating circuits set up as described in the instruction manual.

What do we need for the big job? One 20,000-ohm 10-watt resistor, three .001-μf. disk ceramic bypass capacitors, fifteen inches or so of hookup wire and about 30 minutes. To accomplish the modification, refer to the pictorials in the instruction manual and perform the following steps:

1) Remove the two white wires on Terminal 6 of the operation switch, solder together and tuck out of the way. No insulation is necessary because they are grounded about three inches away.

2) Remove the connecting wire between Terminals HH-1 and E-1.

3) Connect a piece of wire from Terminal 6 of the operation switch (S) to Terminal HH-1 (S).

4) Move the transformer high-voltage center-tap lead from FF-5 to FF-3 (S).

5) Move the lead of the 20K 10-watt resistor from FF-4 to FF-5 (NS).

6) Connect one lead of the additional 20K 10-watt resistor to FF-4 (NS) and the other lead to F-3 (NS).

7) Connect a wire from FF-4 (S) to F-6 (NS).

8) Connect a wire from FF-5 (S) to F-5 (NS).

9) Connect one lead of a 0.001 disk ceramic capacitor to F-3 (S) and the other lead to the nearest ground point (S).

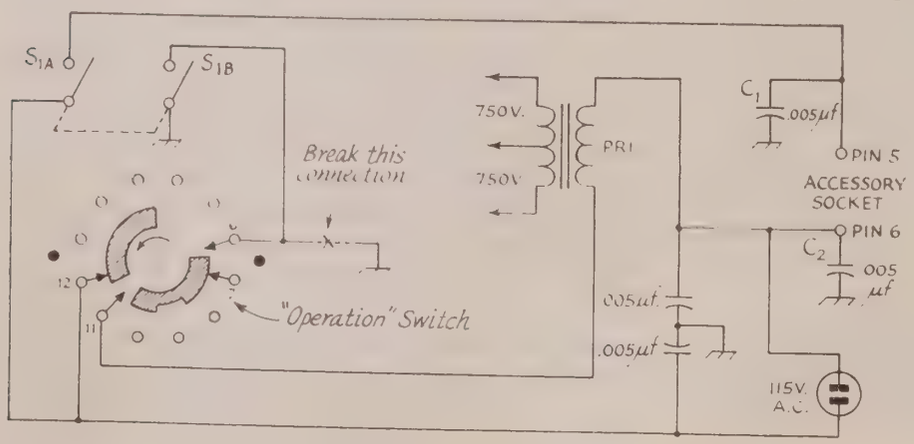

Fig. 3-7—Circuit of W4RVH's improved control circuit for the DX-35 transmitter. C_1 and C_2 (see text) must be rated for 115 volts a.c. S_1 is a d.p.s.t. toggle switch.

10) Connect one lead of a 0.001 disk ceramic capacitor to F-5 (S) and the other lead to the nearest ground point (S).

11) Connect one lead of a 0.001 disk ceramic capacitor to F-6 (S) and the other lead to the nearest ground point (S).

With the above connections made, Terminals 5 and 6 on the auxiliary socket connect to the remote operating switch if one is used for push-to-talk operation. If such a switch is not used, 5 and 6 must be jumpered with a short piece of wire. The addition of a s.p.d.t. switch to any v.f.o. used with the set now will allow the v.f.o. to be turned on without turning on the transmitter since B+ to operate it appears on Terminal 3 of the auxiliary socket regardless of the position of the operation switch.

— Glen R. Jackman, K6ETG

WIDE RANGE LOADING CAPACITANCE USING ONLY FOUR CAPACITORS

ALTHOUGH the circuit shown in Fig. 3-8 is not new, it has not recently been presented in connection with the popular pi-section tank circuit. Its versatility should make it useful in the output portion of a pi-section tank or in other applications where a wide range of capacitance is required, The novel feature of the arrangement is that only four fixed capacitors are required for a ten-step capacitance range covering 100 to 1000 $\mu\mu$f. in steps of 100 $\mu\mu$f. each.

S_{1A} and S_{1B} are mounted on a common index and therefore rotate together. Switch positions 1, 2, 3 and 4 connect the output terminals across capacitors C_1, C_2, C_3 and C_4, respectively, giving a total capacitance determined by the particular capacitor in use. Notice that the capacitance of C_2 is twice that of C_1, and that C_3 and C_4 have a capacitance of 300 and 400 $\mu\mu$f., respectively. Switch positions 5 through 10 connect to various parallel combinations that provide 100-$\mu\mu$f. steps from 500 up to and including 1000 $\mu\mu$f.

Naturally, other ranges of capacitance may be obtained by using proper values of fixed capacitance. For instance, the range will be 200 to 2000 $\mu\mu$f., in steps of 200 $\mu\mu$f. each, if C_1 through C_4 have capacitances of 200, 400, 600 and 800 $\mu\mu$f. in that order.

— H. E. Preston, W2RIZ

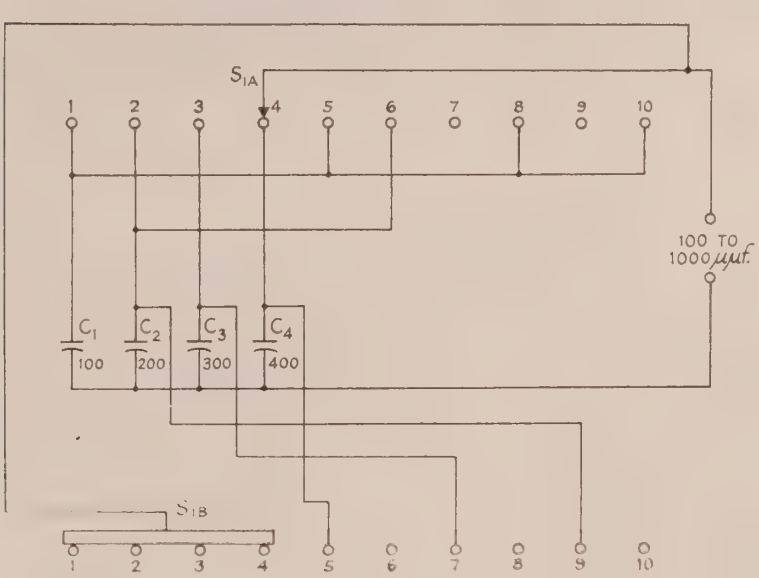

Fig. 3-8—Circuit diagram of the ten-step capacitance system described by W2RIZ. Capacitances are in $\mu\mu$f. S_{1A} is a Centralab type Y wafer and S_{1B} is a type P1S progressively-shorting section. Both switches are mounted on a type P121 index assembly. C_1 through C_4 are discussed in the text.

STABLE OSCILLATOR

HERE is a circuit which will be of interest to those who are experimenting with stable oscillators. The diagram in Fig. 3-9 shows the oscillator. The tuned circuit L_1C_1 determines the frequency of oscillation. Capacitor C_2 is a 50-$\mu\mu$f. variable and is fairly critical in adjustment when the oscillator is first tuned. However, once set, it doesn't require readjustment throughout the tuning range of the oscillator — in my oscillator this was 3.8 to 6 Mc.

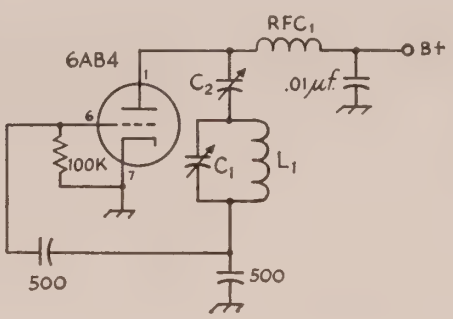

Fig. 3-9—Circuit of the oscillator. Unless otherwise indicated, capacitances are in $\mu\mu$f. The tuned circuit L_1C_1 is tuned to the operating frequency.
C_2—50-$\mu\mu$f. variable capacitor.
RFC_1—2.5-mh. choke.

I plan to add another triode as a cathode follower and to use the oscillator as a v.f.o. There are several points in the circuit from which the output can be taken but the best will have to be found experimentally.

— Clarke Redfield, K2DIG

A SIMPLE METHOD TO LOWER CRYSTAL FREQUENCY

INSTEAD of rubbing a crystal with solder to lower the frequency, rub one side with an ordinary lead pencil. This will lower the frequency much more effectively with less danger of fracturing the crystal itself.

If you overshoot your mark by applying too much lead you can erase it with an ordinary pencil eraser. The first time this method was tried I succeeded in lowering the frequency of a crystal about 36 kc. without breaking or chipping the crystal. The frequency of the crystal has since remained very stable.

— Mike Kaufman, K6VCI

NOTES ON THE HEATHKIT DX-100 TRANSMITTER

THE following suggestions are offered to anyone who owns or contemplates purchase of a DX-100 transmitter. Although the unit is a popular rig as it stands, it can be made more convenient to handle, operate and service by the addition of several minor modifications.

First of all, the four crystal sockets for the transmitter are mounted on the *inside* of the cabinet. Therefore, crystal changing requires the removal of a dozen or more screws and some wrestling with a chassis weighing approximately 100 pounds. This problem can be easily and quickly solved by mounting a crystal socket on the front panel just above the power switch. A short length of 300-ohm cable and a Twin-Lead plug may be used for connection between the new socket and one of the internal sockets.

A pair of utility handles mounted on the top edges of the cabinet will permit more convenient handling of the rig. Mounting of the handles on the sides of the cabinet is not recommended because it prevents a receiver or other piece of equipment being placed directly next to the transmitter. A second pair of handles, mounted on the front panel, will facilitate more convenient removal of the chassis for crystal changing, tube replacement, etc.

The type 1625s in the modulator are the only tubes in the transmitter that may, in the case of failure, create a local procurement problem. Should this situation arise, it may be solved by adapting the modulator circuit to use 807s. This is accomplished by replacing the existing 7-pin sockets with a pair of 5-pin medium sockets, and by wiring the latter as indicated in Fig. 3-10. Except for the sockets and tubes, no other substitution of components is necessary.

Finally, it is recommended that the "Plate" switch be replaced with one of the compact

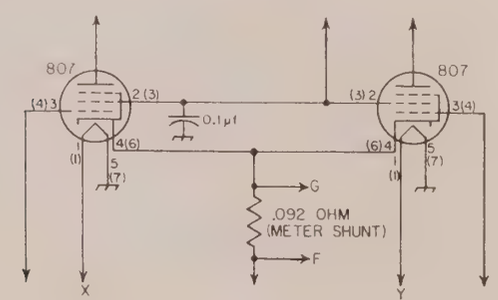

Fig. 3-10—Wiring of the 807 tube sockets for the DX-100 transmitter. Pin numbers in parentheses apply to the 7-pin sockets for the 1625s. Arrows marked F, G, X and Y are designations found on the Heathkit circuit diagram. All other arrows point to original circuit wiring.

heavy-duty types. Considerable sparking occurs within the original switch whenever it is thrown from the transmit to the receive position, thereby indicating the possibility of breakdown at some inopportune moment.

— *Paul B. Boivin, jr., W1ZXA*

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WHILE investigating the cause of a gradual dropping off of drive to the final amplifier of a DX-100 transmitter, it was determined that the 27K ½-watt grid resistor in the 5763 driver stage was changing resistance due to overheating. Replacement of the ½-watt job with one of larger wattage rating cured the trouble.

Incidentally, a small electric fan was used to locate the overheated resistor. The beam of air from the fan was shot around various components until the culprit was located. Naturally, once the overheated resistor was cooled, operation of the transmitter returned to normal. This little hint is passed along because it may prove useful in many other cases of trouble shooting.

— *Charles M. Kugel, W4KOS*

[Editor's Note: Capt. Gilbert L. Countryman, USN-Ret., W4JA, reports that drive difficulties encountered with his DX-100 were also cured by substituting a 2-watt resistor for the ½-watt unit referred to by W4KOS.]

[Editor's Aside: The scheme used by W4KOS is just the reverse of an old Navy system, where we let it run and watched for smoke!)]

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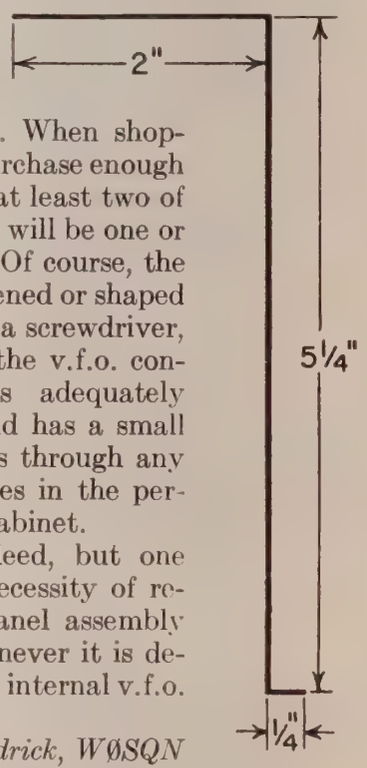
THE little gimmick shown below is used for the alignment of the v.f.o. when the transmitter is enclosed in its cabinet. The stiff piano wire used in making the tool is available at most hobby shops. When shopping for piano wire, purchase enough for the fabrication of at least two of the tools so that there will be one or more spares on hand. Of course, the ¼-inch section is flattened or shaped to resemble the tip of a screwdriver, and fits the slots on the v.f.o. controls. Piano wire is adequately rugged for the job and has a small diameter which passes through any of the ventilation holes in the perforated cover of the cabinet.



A simple tool, indeed, but one that eliminates the necessity of removing the chassis-panel assembly from the cabinet whenever it is desirable to touch up the internal v.f.o. controls.

— *T. G. Pedrick, WØSQN*

CURING REGENERATION IN THE BAND-SWITCHING KILOWATT

THE following will be of particular interest to those who employ the circuit described in "High-Power Pi-Network Amplifier with Parallel Tetrodes," *QST*, May, 1954. One such amplifier, bothered by a case of persistent regeneration, was made completely stable by removing one tube from the circuit. Because of this, it was suspected that screen-circuit difficulties were involved. This reasoning was substantiated, and a cure effected, by installing a screen-trap arrangement suggested by the diagram of the Collins KW-1. The circuit as applied to the parallel-tetrode amplifieris shown in Fig. 3-11.

As installed in the amplifier, the traps are mounted above the chassis deck with the bypass

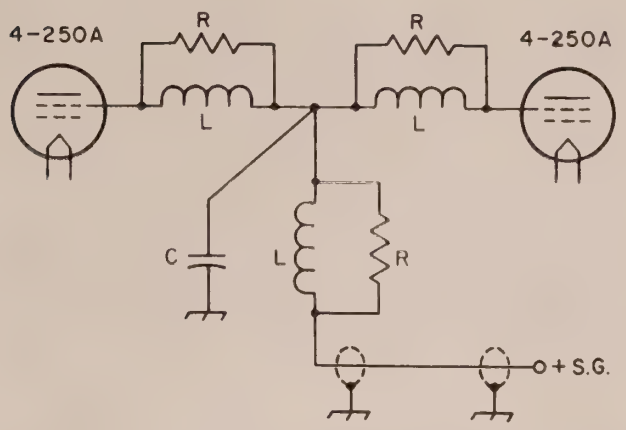


Fig. 3-11—Circuit of the screen trap for the high-power pi-network amplifier.
C—470-$\mu\mu$f. ceramic.
R—47 ohms, 2 watt (carbon).
L—5 turns No. 18 or 20, ½-inch diam.; wound around associated resistor in each case.

capacitor returned to a grounded lug located at the base of the tubes. The 330-$\mu\mu$f. ceramic capacitors — all four — used to bypass the screen grids of the original amplifier must be removed from the circuit when the traps are installed. Of course, the incoming screen-voltage lead is made with shielded wire. — *Willard Bridges, W1NWO*

MULTIPLE POSITION CRYSTAL HOLDER

A SIMPLE and inexpensive holder for a group of crystals may be made by mounting salvaged tube socket clips in a sheet of plastic.

Holes drilled to accommodate the clips should have a diameter slightly smaller than that of the clips. This will allow the clips to be force fitted into place. Heating each one with a hot soldering iron will seal it to the plastic. Naturally, the heat should be applied with caution so as not to completely melt the holder.

— *Lowell F. Lind, K4AWQ*

HOMEMADE NEUTRALIZING CAPACITOR

A HOMEMADE neutralizing capacitor that has some advantages over commercially-made units is shown in Fig. 3-12. The method of construction permits bringing one terminal of the capacitor directly through a chassis, thus eliminating the extra feed-through insulator ordinarily required. The capacitor requires a minimum of

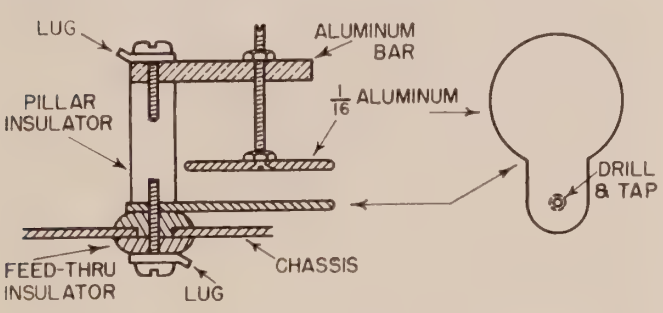


Fig. 3-12—Drawing of the homemade neutralizing capacitor used by W1SIZ/6.

chassis area for mounting, and can be made to any desired maximum capacitance commensurate with high-voltage spacing requirements.

Capacitors of this type may be tailor-made for the popular capacitive neutralizing systems such as those described in Chapter Six of *The Radio Amateur's Handbook.*

— *Thomas F. Snyder, ex-W1SIZ*

DECAL COATER

THE exasperating experience of having decals wrinkle because of a slight overdose of lacquer or plastic spray induced me to find a sure-fire non-curl method of coating. The solution — Polaroid Print Coater. It comes supplied with every package of Polaroid Land film and is used to protect the pictures from grease and give a lustrous finish to the print. Place some of the solution over the decal with the applicator and you have a non-wrinkle coating.

— *Richard E. Bakula, KØMOD*

A TRANSISTORIZED OSCILLATOR FOR 3.5 MC.

HAMS have found many applications for junction transistors, even though many previous types have been limited to audio and intermediate frequencies. A recent transistor is Raytheon's type 2N112 (formerly known as CK760). It has a cut-off at 5 Mc. and easily oscillates at 3.5 Mc. and above with only a 1.5-volt source of power.

The schematic in Fig. 3-13 is that of a simple oscillator useful at 3.5 Mc. and its harmonics. With a crystal inserted into the socket, C_1 tunes broadly to the desired frequency. For v.f.o. output, remove the crystal and insert a dummy crystal holder with its *terminals shorted.* Then C_1 tunes the band with sufficient overlap at each end. The tone is T9 and remains steady as a rock after a minute or two drift.

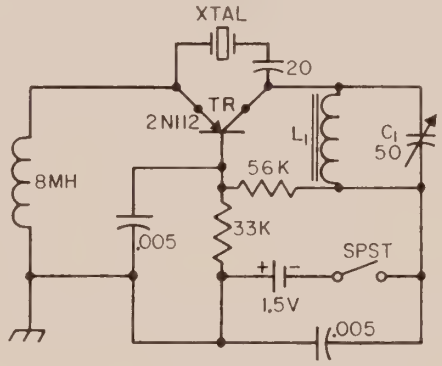


Fig. 3-13—Circuit diagram of the transistorized oscillator. L_1 is the plate winding of a broadcast-oscillator coil (Meissner 14-1058 or equivalent).

This circuit may be used as a signal generator for ham frequencies, calibration purposes or as an external b.f.o. for a short-wave receiver having no beat oscillator of its own. Simply tune the transistor circuit approximately to that of a c.w. signal. This creates a beat with the incoming signal. No need to alter the receiver.

The oscillator uses less than 0.5 ma. at 1.5 volts, but it can be driven safely with up to 6 volts.

— *Nathaniel Queen, W2CPA*

CAPACITIVE NEUTRALIZING HINT

THE capacitive neutralizing circuit for screen-grid tubes shown in Fig. 3-14 will be recognized as the basic arrangement described in Chapter 6 of *The Radio Amateur's Handbook* (see "Stabilizing Amplifiers"). It differs from the *Handbook* system only in that the grid bypass, C_1, is the *variable* control while the neutralizing capacitor, C_2, has a *fixed* value.

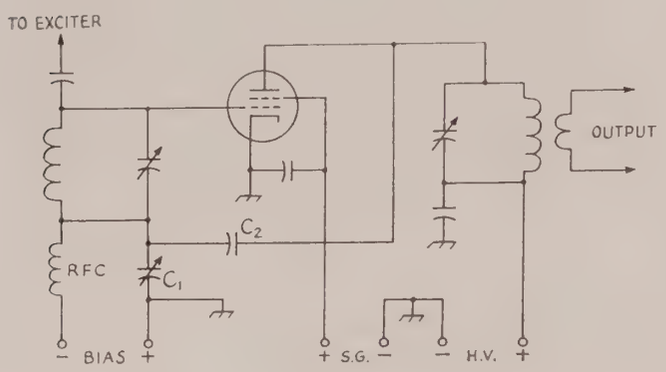


Fig. 3-14—Circuit of a screen-grid amplifier using the capacitive neutralizing arrangement suggested by W1LU. Notice that a variable capacitor, C_1, is used as the grid-circuit bypass, and that the neutralizing capacitance is of fixed value. Neutralizing is accomplished by adjustment of C_1.

In practice, C_2 usually has a very low value of capacitance — approximately 2 to 10 $\mu\mu$f. Voltage rating for the capacitor must be the same as the amplifier plate voltage for c.w. work and twice this value when plate modulation is used. A *variable* capacitor that will meet these specifications is not always easily come by. However, a suitable fixed unit can usually be easily located or quickly fabricated from scrap aluminum. Of course, the fixed capacitor may be used as long as the grid bypass capacitor, C_1, is variable. Fortunately, compact wide-range padder capacitors that have adequate voltage rating for grid-circuit duty are available. The voltage rating required must equal the operating bias of the amplifier tube. The knowing ham will select a conservative rating that allows some safety factor.

— *William S. Allen, W1LU*

NEUTRALIZING HINTS

AN ordinary vacuum-tube voltmeter, coupled by means of an r.f. probe to the output circuit of a transmitter, serves well as a sensitive "feed-through" indicator while neutralization adjustments are being made. With excitation and filament voltage applied to the final amplifier tube (be sure to kill the plate and screen voltages), adjust the neutralizing capacitor for minimum reading on the v.t.v.m.

If the transmitter is completely shielded and coupled to a coaxial output line, insert a coax Tee-coupler between the amplifier and the line to provide a tap point for r.f. probe.

— *V. L. Clark, W6ZW*

WHEN experimentally determining values for a capacitive neutralizing system, it is extremely convenient if both the grid bypass and grid-plate capacitors can be of variable design. The variable grid-plate capacitor, usually a tab of aluminum or a commercial unit, presents no problem, but a 1000-$\mu\mu$f. variable for the grid bypass may be a bit hard to locate, unless you happen to remember that a 3-section broadcast tuning capacitor, used with all three sections connections in parallel, will give a total capacitance of better than 1000 $\mu\mu$f.

After adjusting the circuit for neutralization of the amplifier, the capacitance of the large variable may be estimated so that the unit may be replaced with a fixed capacitor.

— *Charles R. Brown, W1HZE*

CHANGING CRYSTAL FREQUENCIES

THE usual procedure for changing crystal frequency involves grinding, which is fine for making large changes or for certain low-frequency crystals. However, for small changes insuring stability of frequency when reached, and also for insuring that the activity of the crystal is not diminished by the change, etching is preferred.

Etching material used commercially (ammonium biflouride) is not commonly found at the corner drugstore. Fortunately there is a ready source of this chemical in a preparation sold as an aluminum cooking utensil cleaner called "Aluminum Brite." Since it attacks glass or ceramics, it comes in a plastic bottle.

When etching crystals, put about an ounce in a plastic dish (or you can use copper or stainless steel) at room temperature. The action is greatly accelerated by heat but by the same token becomes harder to control. Bend a copper wire hanger to hold the crystal blank in the etching solution. As an indication of the speed of etch, it takes about eighteen minutes to move a 7-Mc. crystal 8 kc.

Determine the frequency accurately before starting, and make a trial etch of five minutes. Wash and dry the crystal and contact electrodes and reassemble in the holder. Use the same holder for checking that will finally be used with the crystal so that capacity, pressure, etc., will not be changed. Cleaning is important for high frequency crystals for two reasons. First, the crystal will have difficulty oscillating if not clean; second, the solution apparently leaves an invisible deposit, which if not removed will load the crystal and give a lower than true frequency.

Since etching reaches all surfaces of the crystal there are no changes in the proportions. Hence the activity is unchanged for moderate frequency shifts. There is less danger of chipping or breakage since handling is at a minimum. Grinding leaves a microscopically fine dust in the surface pores of the crystal which gradually comes off and causes an upward drift in frequency. Etching eliminates this problem.

— *J. H. Ellison, W6AOI*

4. Hints and Kinks . . .

for the Phone Rig

NOVEL PUSH-TO-TALK CIRCUIT

IMPULSE or latching relays are a handy means of providing push-to-talk operation without need for holding the talk button down during transmissions. The button, in such applications, is pushed momentarily to turn the transmitter on and pushed momentarily again to turn it off. The main disadvantage of such relays is the price tag, which generally starts at about eight dollars and goes up. However, a simple counting circuit using two surplus relays can be employed to achieve the same end.

Fig. 4-1 shows the circuit with the two relays energized. Here's how it works: When the button is pushed, K_1 is grounded through the normally-closed contacts of K_2. When K_1 operates, the transmitter control circuit is completed through contacts K_{1B} and the top end of K_2 is grounded through contacts K_{1A}. Notice that the bottom end of K_2 is permanently grounded and that the return supplied through K_{1A} does not cause the relay to close. Nothing further happens until the push button is released.

Releasing the button removes the ground from the junction of K_1 and K_2, leaving the two relays in series across battery BT_1. K_2 now operates. Contacts K_{2A} transfer one side of the button to the coil of relay K_2, while contacts K_{2B} connect the other side of the button to battery BT_2. Nothing comes of this since both relays are locked in the "operate" position and the push-button is released.

When the push-button switch is is again closed, voltage from BT_2 is applied to both relays through contacts K_{1A}, K_{2A} and K_{2B}. K_2 will "hold," but K_1 will open because it now has plus-voltage at both ends of its solenoid. When the button is released, voltage from BT_2 is removed from K_2, the relay opens and the circuit is ready for another complete cycle.

Proper operation of the circuit necessitates that both relays have the same coil resistance and current rating, and that the supply voltage be twice the rated voltage of a single relay (24 volts for two 12-volt relays, 12 volts for two 6-volt relays). One other requirement is apparent from close examination of the circuit: with the button released after having turned the transmitter on, it is essential that contacts K_{1A} must maintain a voltage path (from BT_1) for K_2 long enough for the current to build up to the point where the resultant voltage drop will hold both relays closed. Should K_1 open before this happens, K_{1A} will remove voltage from K_2 and *both* relays will open. This means that relay K_1 should have a reasonably long time constant, which most relays have. If both relays drop out after the button is released, the release time of K_1 is too short and the effect can be remedied by connecting a crystal diode across the coil. Also, the spring tension can be reduced for increased "hold" time.

For the purpose of description, it was assumed that d.c. relays would be used. A.c. relays would do just as well as long as the above requirements are met. — *Robert S. McMullen*

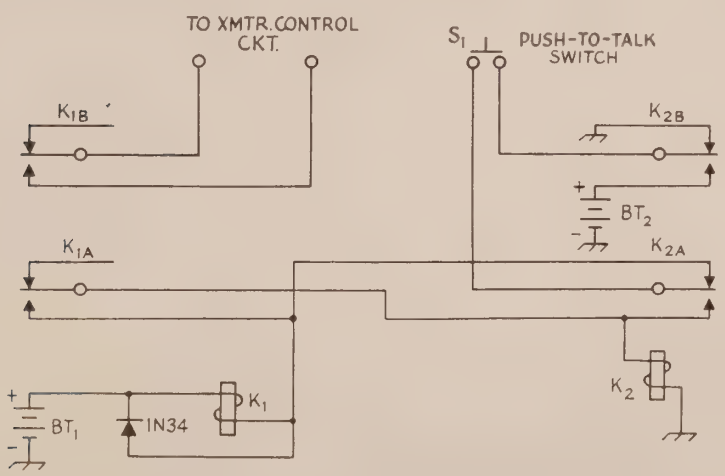


Fig. 4-1—Schematic diagram of WØLOV's push-to-talk circuit. See text for component specifications. S_1 is the push-to-talk switch or microphone button of the momentary contact type.

EMERGENCY MODULATOR

After many enjoyable hours using my 80- and 40-meter c.w. rig I decided to try my luck on phone. I didn't have a modulator so I tried to think of an inexpensive way to convert to phone operation. I had an old television power transformer and an old phonograph audio amplifier with a microphone preamplifier stage. These parts connected as shown in Fig. 4-2 made up my new modulator.

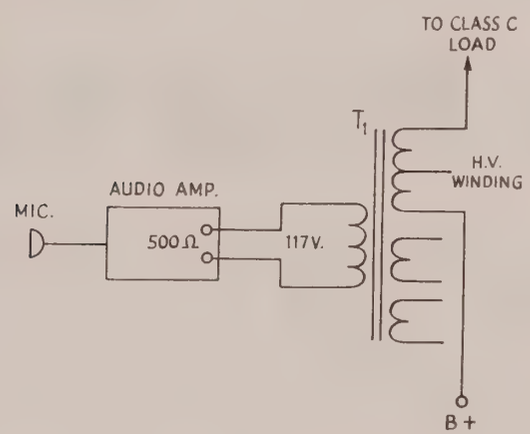


Fig. 4-2—Circuit showing a modulator using a power transformer modulation transformer.

T_1—Power transformer.

Only a few connections are required for the modification and it is an easy job to shift back to c.w. Reports on the voice quality are excellent and many successful phone contacts have been made. — *David T. Saussier, jr., W3MLE*

INPUT CIRCUIT FOR EITHER CRYSTAL OR CARBON MICROPHONES

The circuit shown in Fig. 4-3 permits feeding the output of either a crystal or a carbon microphone to the speech-amplifier tube. The closed-circuit jacks automatically convert the circuit

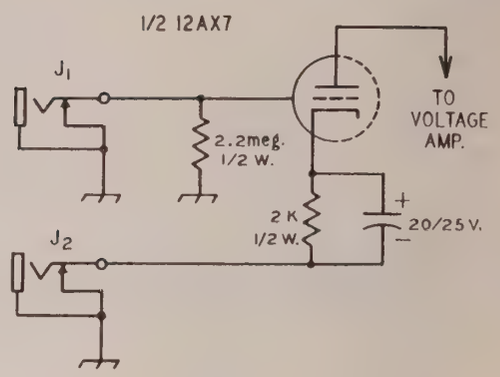


Fig. 4-3—Schematic diagram of the speech amplifier designed for either crystal or carbon-microphone input.

for whichever type of microphone is used. When using a crystal or other high-impedance microphone, it is plugged into J_1. In this application, the cathode circuit for the 12AX7 is completed through J_2. With J_1 closed (microphone plug removed) and with a carbon microphone plugged into J_2, the stage operates as a grounded-grid amplifier. The second half of the dual triode is used as a conventional voltage amplifier with a gain control in the grid circuit.

— *Vernon Phillips, W7NPV*

REMOTE F.M. MODULATOR FOR V.F.O.s

The circuit in Fig. 4-4 shows a six-meter remote tuned f.m. modulator and v.f.o. that makes use of the junction capacitance of a silicon semiconductor diode.

The v.f.o. consists of a standard 8-Mc. Clapp oscillator with the diode (CR_1) connected in the tuned circuit. The 12AX7 modulator is connected to the v.f.o. through a length of shielded wire.

When audio is applied across the diode, the junction capacitance varies and changes the frequency of the oscillator at an audio rate, producing frequency modulation. Deviation of the system is controlled by the gain of the modulator. — *Leonard Kudravy, K3ASU*

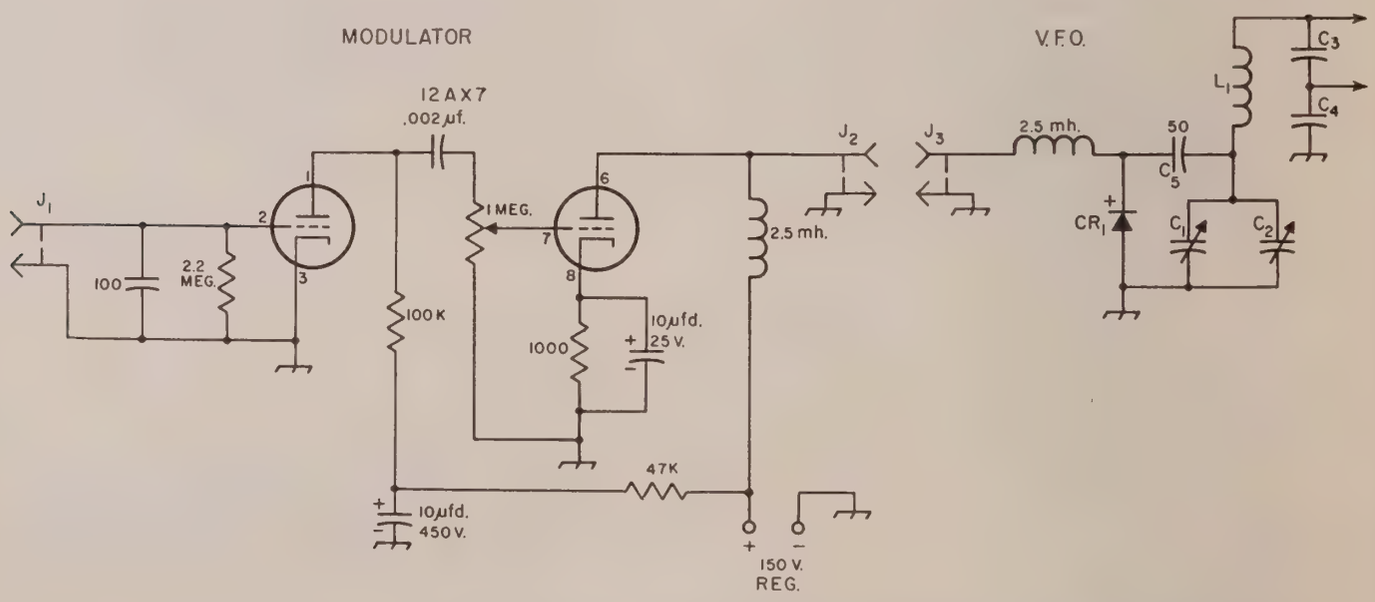


Fig. 4-4—Circuit of the f.m. modulator. Unless otherwise indicated, capacitances are in μμf., resistances are in ohms, resistors are ½ watt. L_1, C_1, C_2, C_3 and C_4 determine the frequency of oscillation of the Clapp oscillator.

C_1—15 μμf. variable.
C_2—75 μμf. variable.
C_5—50-μμf. silver mica.
CR_1—Westinghouse 1N1169 diode.
J_1—Microphone jack.
J_2, J_3—Phono connectors.

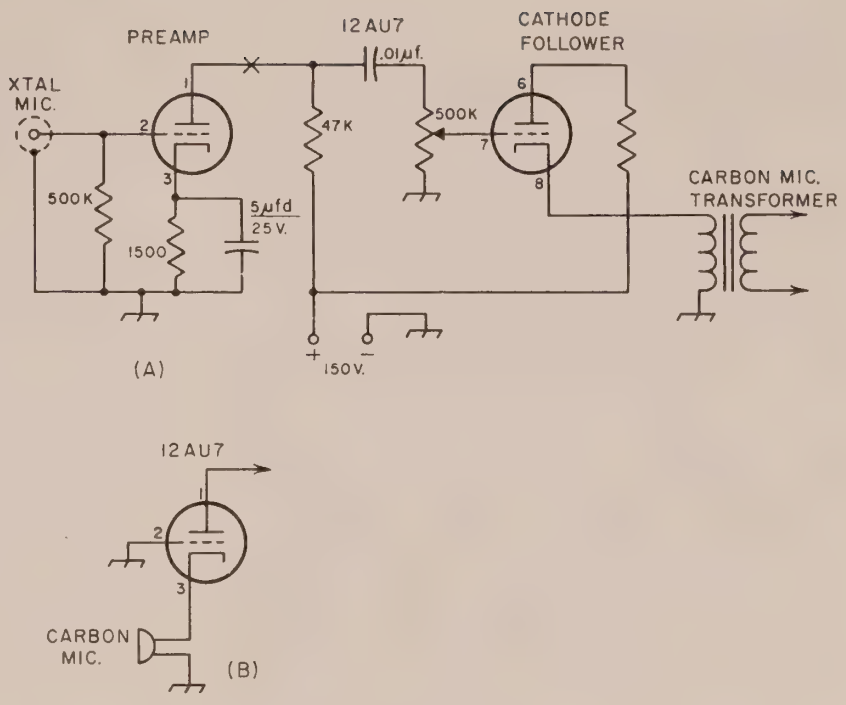


Fig. 4-5—Microphone circuits. All resistors are ½ watt. The cathode follower plate load resistor is 47,000 ohms.

MICROPHONE CIRCUITS

THE speech quality of a transmitter that uses a carbon microphone can be improved by substituting a crystal microphone. The diagram shown in Fig. 4-5(A) shows a 12AU7 crystal microphone preamplifier and cathode follower which feeds into the low-impedance winding of a carbon microphone transformer. Fig. 4-5(B) shows an alternate preamplifier circuit which will provide more gain for a carbon mike. Here, the tube is connected as a grounded-grid amplifier. The carbon microphone receives its operating voltages from the 12AU7's cathode current. If this circuit is used, it should be substituted for the part to the left of point "X" in Fig. 4-5(A).

— H. J. Hoechestetter, W6UVM

REVAMPED AUDIO CIRCUIT FOR VIKING TRANSMITTERS

BECAUSE of low output from a microphone or the desire to modulate when located some distance from the microphone, many amateurs appreciate information directed at increased output from existing audio gear. The following is a report of work done on the audio circuits of a Viking I transmitter used here at W6ZLW. Prior to the modification, and when using my particular microphone, it was necessary to talk loud and *close* with the gain turned full on in order that adequate modulation might be obtained. With the new speech layout, it is possible to obtain 100 per cent modulation while talking at a normal level when located 4 or 5 inches away from the microphone and with the gain control set at the approximate middle of the scale. On-the-air reports indicate that the quality of the system is still excellent even though the low-level stages have been completely done over.

Fig. 4-6 shows the new tube lineup that is used to replace the original speech-amplifier and driver circuits. One half of a Type 12AX7 is used as the input tube and the second section of the envelope is used to excite a 12BH7 dual triode (connected in parallel), which in turn drives the 807 modulator for the transmitter. The original gain control for the rig, R_1 of Fig. 4-6, is connected in the grid circuit of the second half of the 12AX7. Incidentally, a 12AU7 may be substituted for the 12BH7 with very little difference in actual operation. However, no suitable substitution for the 12AX7 has been found.

When making the modification, it is necessary to replace the old 6AU6 tube sockets with 9-prong jobs. Be sure to use shielded sockets and place them exactly where the original ones were located (enlarge the old mounting holes). When removing components, do so with care because several parts can be used in the new layout. Make certain that the 12BH7 occupies the spot previously used by the 6AU6 driver tube. Also, notice that shielded wire is used between the microphone jack and the 0.005-μf. coupling capacitor.

Several other W6s have been highly pleased with the results obtained by the above means. Furthermore, no one who has faithfully followed instructions pertaining to tube layout reports feed-back difficulties at any of the frequencies for which the rig is designed. On the other hand, failure to follow instructions has resulted in audio problems.

— William T. Seeley, W6ZLW

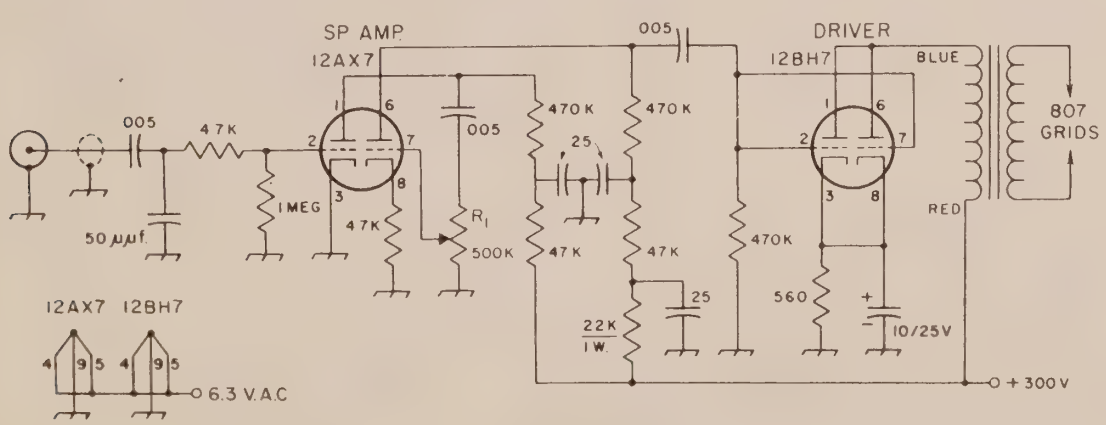


Fig. 4-6—W6ZLW uses this low-level speech arrangement to drive the 807 modulator of a Viking 1 transmitter. Unless otherwise specified, capacitances are in μf.

MORE ABOUT THE 6Y6 AS A CLAMP TUBE

RECENTLY, while attempting to plate and screen modulate one of the *Handbook* rigs, severe downward modulation occurred. The transmitter uses a Type 807 in the r.f. amplifier and employs a 6Y6 clamp-tube protective circuit. Although voltages on the 807 checked normal under static conditions, the plate current dipped from the full-load value to about 60 ma. when modulation was applied. A cure for this condition was effected merely by removing the 6Y6 from the circuit.

The problem and its cure led to an investigation of clamp-tube operation of several 6Y6s. It was determined that the tubes went into conduction with as much as -90 volts applied to the control grid whenever the plate-screen potential was raised to approximately 350 volts. Obviously, this is an undesirable condition for phone operation for it permits the clamp tube to operate as a clipper on the positive peaks of the modulation cycle.

The only solution to the problem appears to be either the removal or the disabling of the clamp tube when the r.f. amplifier is to be modulated. Of course, this leaves the modulated amplifier without protective bias unless some other form of fixed bias is installed.

— William F. Baumruck, W9DTC

USING A CLAMP TUBE WITH PLATE-MODULATED R.F. AMPLIFIERS

THE problem of clamp-tube conduction on positive modulation peaks, described by W9DTC above, finds a ready solution. A clue is contained in the words "whenever the plate-screen potential is raised to approximately 350 volts."

If the tube is pentode-connected, using the plate alone to provide the clamping load, while feeding the screen from a separate voltage source, advantage may be taken of the characteristic of screen-grid tubes which makes their plate-current roughly dependent upon screen voltage rather than plate voltage.

In the circuit shown as Fig. 4-7, the plate of the clamp tube is connected to the screen of the protected stage and the screen of the clamp tube is tied to a bleeder tap providing approximately 100 volts. If this tap is properly selected, screen dissipation may be kept within rating under key-up conditions, while the protected stage actually has lower key-up screen voltage and therefore lower idling plate current. Since the bleeder tap does not change in voltage with modulation, the clamp tube will not conduct on modulation peaks. Key-up, however, the stiff voltage on the clamper screen allows its plate to draw a heavier current than can be drawn if triode connected.

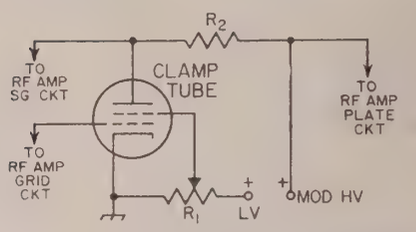


Fig. 4-7—Screen clamper circuit for protecting plate-modulated screen-grid power tubes. R_1 is referred to in the text. R_2 is the screen-dropping resistor for the r.f. power tube.

This clamp-tube circuit was not originated at W2KTF. It is used in several commercially designed amateur transmitters.

— Charles Baker, W2KTF

6BE6 PREAMPLIFIER FOR BOTH HI- AND LO-Z MICROPHONES

PREAMPLIFIERS constructed here in the past have always employed either two high-gain tubes or a dual-triode in order that both crystal and dynamic (low-put type) microphones could be used.

Recently, while working out design details for a completely new amplifier, the thought occurred that one of the popular r.f. mixer tubes might operate satisfactorily in a *single-tube triple-purpose* circuit having provision for both crystal and dynamic-mike input and, at the same time ability to serve as the mixer.

To test the theory, a type 6BE6 pentagrid converter tube was tested in the circuit shown as Fig. 4-8. After settling on the component values listed, the arrangement actually exceeded my fondest hopes. By connecting the dynamic-microphone transformer to grid No. 1 of the tube, and the crystal mike to grid No. 3, not only did a rather neat mixer result, but the over-all gain of the amplifier remained essentially constant regardless of which microphone was used. Apparently, the difference of approximately 20 db. in gain that the No. 1 grid arrangement has over the grid No. 3 circuit compensates for the difference in microphone output levels.

It is reasonably certain that the idea is not completely new, but it is one that I have never seen in print. Perhaps the circuit won't find too much application in ham-band equipment, but it may appeal to amateurs interested in hi fi, recording, etc.

— Fred L. Mason, KH6OR

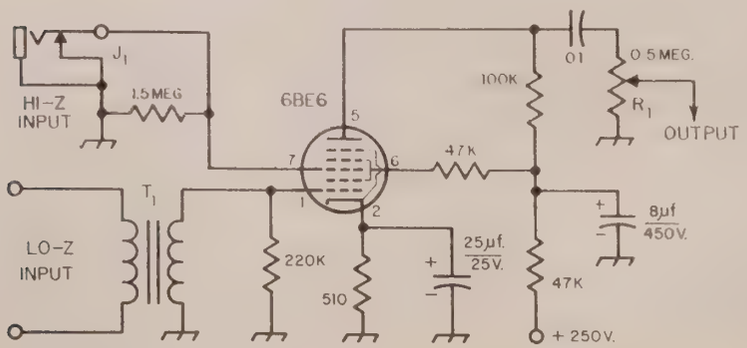


Fig. 4-8—KH6OR uses this preamplifier-mixer circuit with both crystal and dynamic microphones. R_1 is the gain control for the amplifier stages following the 6BE6. T_1 is a dynamic-microphone-to-grid transformer. All resistors except R_1 are ½-watt composition. Capacitors marked with polarity are electrolytic.

INEXPENSIVE SCREEN-GRID MODULATOR

HERE is a simple method of screen-grid modulation. It makes use of a low-power audio amplifier with a low input impedance. A radio, TV or phono amplifier may be used for the modulator. The audio amplifier used here at K2MYC is a phono amplifier capable of two and a half watts maximum output of audio, more than ample to modulate a pair of 807s.

The only change necessary in the audio amplifier is to disconnect the two wires coming from

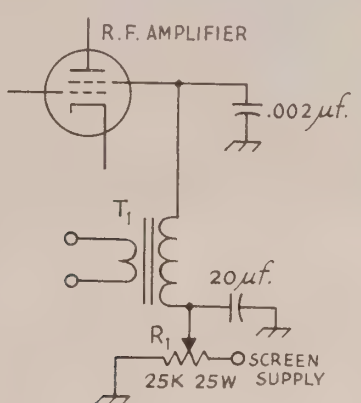


Fig. 4-9—Diagram of the screen-grid modulator. T_1 is a small audio output transformer, pri. 4000–10,000 ohms, sec. 4–8 ohms.

the audio output transformer to the speaker. The audio output transformer T_1, Fig. 4-9, was salvaged from a junked radio. The screen-grid voltage should be obtained from a fixed voltage supply with a voltage divider, R_1. Tune the transmitter for maximum output on c.w. using heavy loading; then reduce grid drive until a slight increase in plate current is observed. Note the plate current, then reduce the screen-grid voltage until the plate current is one half the original value. Connect the microphone to the audio amplifier input, then advance the volume control on the amplifier until small upward kicks of plate current are observed on voice peaks. The transmitter is now modulated.

— *Frank Seier, K2MYC*

"HOW'S MY MODULATION?" INDICATOR

SELDOM are "on-the-air" reports critical enough, particularly as to quality of modulation, and since it is virtually impossible to tell anything by listening to yourself with a monitor, the following scheme has been adopted at W2PFU for adjusting the phone rig for minimum distortion, correct clipping level, general speech quality, hum, etc.

A three- or four-foot length of wire and a 1N34 germanium diode are coupled into the microphone input of a wire recorder placed on a table a few feet from the transmitter, as shown in Fig. 4–10. The wire recorder is turned to "record" position, the transmitter is turned on, and, while the adjustments are being made, the operator describes the adjustments, dial settings, and other pertinent data. At the conclusion of the series of adjustments the transmitter is turned off and the material recorded on the wire is played back. This gives the operator a personal and first-hand description of just what his modulation does sound like. Obviously, during the test the input level to the wire recorder must be adjusted to the proper recording level.

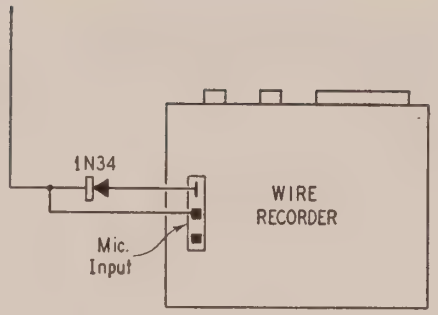


Fig. 4-10—Connections used by W2PFU to permit recording of his own signal.

Tests can be made with the transmitter loaded into a dummy antenna or while the operator is in QSO with another amateur. Broadcasting your tests to the world is not recommended.

— *Dallas T. Hurd, W2PFU*

MORE ABOUT THE "HOW'S MY MODULATION?" INDICATOR

WHILE TRYING to apply W2PFU's hint for checking modulation (see above), I found myself without a germanium diode. Needing to make the check in a hurry, the demodulation probe for an oscilloscope was put to work. Output from the probe was fed directly to the tape recorder. A short length of wire connected to the tip of the probe provided adequate r.f. pickup.

In some later checks made with both the probe and the plain diode, it was determined that the use of the probe resulted in best reproduction of the modulated signal. This does not mean that you *must* run out and buy a probe if you want to use the W2PFU system, but it certainly means that the probe *should* be put to work in this application if you already have one on hand.

— *David Berkley, K2MUN*

CRYSTAL MICROPHONE TIPS

MOST crystal microphones contain a Rochelle salt crystal which should be protected from high temperature, humidity, and high voltage. The Rochelle salt crystal can be permanently damaged by temperatures above 125 degrees F. (50 degrees C.) and by excessive humidity. The best service from a crystal microphone will be obtained if it is used at room temperature, at a humidity of about 50 per cent. Since inside automobile temperatures rise to high values in the summertime, it's not a good idea to use crystal microphones for mobile service during hot weather. Be careful when soldering connections to a crystal mike. Don't connect the mike to speaker or power outlets carrying high voltage.

— *R. Bruce Campbell*

THE SIMPLEST MODULATOR

MANY c.w. operators have been looking for an easy way to modulate their rigs, and this little modulator may be the answer.

The interesting point about it is that it can be plugged into the cathode circuit of any final amplifier and you are on phone. No separate plate supply or matching output transformer is needed. The plate voltage for the unit is derived from the final plate supply.

As shown in Fig. 4-11, the audio output voltage is impressed between the r.f. amplifier cathode and ground, giving principally grid-bias modulation of the amplifier although there is a small amount of accompanying plate and screen modulation. You can modulate triodes, tetrodes or pentodes, single-ended or push-pull. The efficiency is comparable with that of other grid- or screen-modulation systems and so, of course, cannot equal plate modulation, but good quality reports will be obtained. One feature of the system is that, with most finals at least, proper operating conditions for good modulation are attained practically automatically.

The speech amplifier uses a double-triode 6SL7GT with resistance coupling, and gives adequate gain for a crystal microphone. Plate voltage comes from the amplifier cathode, with C_1, C_3, C_6, R_3, R_7, and R_{10} providing additional filtering as well as decoupling. The voltage will vary with the power of the transmitter, but in any event the measured voltages at the 6SL7 plates are quite low. R_{11} is not needed if the modulated amplifier is operating at such low power that the voltage at the screen of the 6Y6G does not exceed the maximum rating of 135 volts.

To use the modulator, first tune up the transmitter for c.w. operation and load it to normal input. Then connect the modulator into the amplifier cathode circuit — it can be plugged in in place of the key if there is a key jack in the cathode — and the plate current should drop to about half its c.w. value. Then talk — that's all

Fig. 4-12—Practically any layout you want can be used for the modulator. The unit at W6LNN uses the circuit of Fig. 4-11 and has ample gain for a crystal microphone. A carbon microphone could be coupled to the modulator grid through the usual transformer, without speech amplification.

there is to it! The r.f. amplifier plate current should remain steady except possibly for a slight flicker on voice peaks. In the event that the plate current with the modulator plugged in is considerably above half the c.w. value, it can be brought into the right region by increasing the value of resistor R_9.

One word of caution, especially when using powers over 200 watts or thereabouts: Be sure the modulator filaments are ON before applying plate voltage. This will insure the proper path of the final cathode current and prevent possible burnout of the small audio filter choke in parallel with the 6Y6G circuit. This applies particularly to separate control of filament voltages.

The unit is built into a 6¼ × 3½ × 2-inch

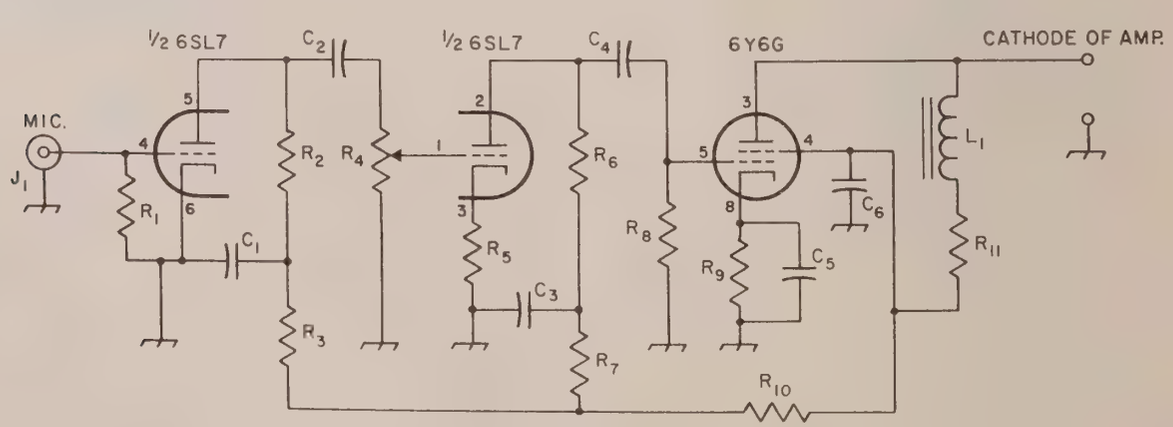


Fig. 4-11—Circuit diagram of the speech amplifier and modulator.

C_1, C_3—0.1-μfd. paper, 400 volts.
C_2—0.005-μfd. paper, 400 volts.
C_4—0.01-μfd. paper, 400 volts.
C_5—50-μfd. electrolytic, 50 volts.
C_6—8-μfd. electrolytic, 450 volts.
R_1—2.2 megohms, ½ watt.
R_2—0.22 megohm, ½ watt.
R_3, R_7, R_{10}—22,000 ohms, ½ watt.
R_4—0.5-megohm volume control.
R_5—2200 ohms, ½ watt.
R_6, R_8—0.1 megohm, ½ watt.
R_9—50 ohms, 2 watts (see text).
R_{11}—2000 ohms, 2 watts (see text).
L_1—Small filter choke, "a.c.-d.c." type satisfactory.

"channel-lock" box. This size accommodates all the parts except the small audio choke.

In estimating the number of tubes required to modulate a given transmitter, allow one 6Y6G for each 200 ma. of c.w. plate current or 100 ma. when the modulator is plugged in. One tube will modulate up to 200 ma. c.w. current, two tubes up to 400 ma., and so on, it being understood that these values should drop to one-half when the modulator is in circuit. Type 6L6 tubes can be substituted for the 6Y6G but are not as desirable because higher plate and screen voltage are required for the same cathode current. Since the voltage drop across the modulator tube or tubes subtracts from the voltage actually applied between plate and cathode of the modulated amplifier, a larger tube drop means a reduction in power input to the final amplifier stage.

In typical cases, scope patterns have shown that with tone input very good waveform is obtained up to about 80 per cent modulation. The positive peaks are somewhat clipped with heavier modulation, but the distortion is not particularly noticeable even at 90 per cent modulation.

The simplicity of the unit makes it readily adaptable to portable rigs. It would also be useful as a spare modulator when the regular high-powered speech system needs attention.

— Ira F. Gardner, W6LNN

THREE-WAY SWITCH FOR THE SIMPLEST MODULATOR

OPERATORS who employ the "Simplest Modulator" for casual phone operation with their existing c.w. rigs must remember to unplug the modulator whenever the mode of operation is changed from phone to c.w. Of course, if the cathode of the final is keyed and if the modulator output terminals are connected in parallel with those of the key, the unplugging motion is unnecessary. However, in installations where the oscillator or a low-level stage is keyed, it is necessary to disconnect the modulator so that the r.f. output tube may work at normal input.

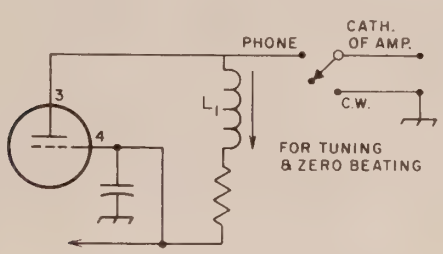


Fig. 4-13—Circuit diagram of the switching system described by W3PVY. (If the leads to the switch are long, be sure to connect an 0.001-μf. disk ceramic between amplifier cathode terminal and ground.)

The circuit shown in Fig. 4-13 shows how a single-pole three-position switch has been put to use with the transmitter and modulator used here at W3PVY. Two of the switch positions provide for rapid change over from phone to c.w. operation, and the center or third contact allows the final to be disabled during zero-bearing or tuning adjustments.

To clarify the circuit of Fig. 4-13, it should be mentioned that all components other than S_1 are ports of the modulator circuit appearing on the previous page.

— Ed Rittenhouse, W3PVY

PARALLEL 6Y6s FOR THE SIMPLEST MODULATOR

THE simple grid modulator described by W6LNN on the previous page has usually lived up to its name if constructed with a single tube in the output stage. However, the installation of parallel 6Y6s in the modulator has occasionally resulted in instability within the unit. With the assistance of W8RXX, and with the addition of a few inexpensive components, it has been possible to stabilize the parallel-tube arrangement. Fig. 4-14 shows the revised circuit which, incidentally, is used to modulate the popular 4–250A amplifier described in recent editions of the *Handbook*.

Many of the components shown in Fig. 4-14 bear designations — R_6, C_6, L_1, etc. — which refer to the original diagram inasmuch as these parts remain unchanged in both value and placement. With respect to the original circuit, it should be mentioned that the 6SL7 section of the unit requires no modification. L_2 and L_3 and resistors R_{12} through R_{15} are the recent additions to the modulator and are the components which stabilize the new arrangement. R_9 of the one-tube layout has been replaced with a 100-ohm variable to provide a convenient means of adjusting the plate current of the r.f. amplifier. This adjustment is particularly helpful when resetting the plate current to *half value* after band changing.

— Philip J. Hart, W8MMK

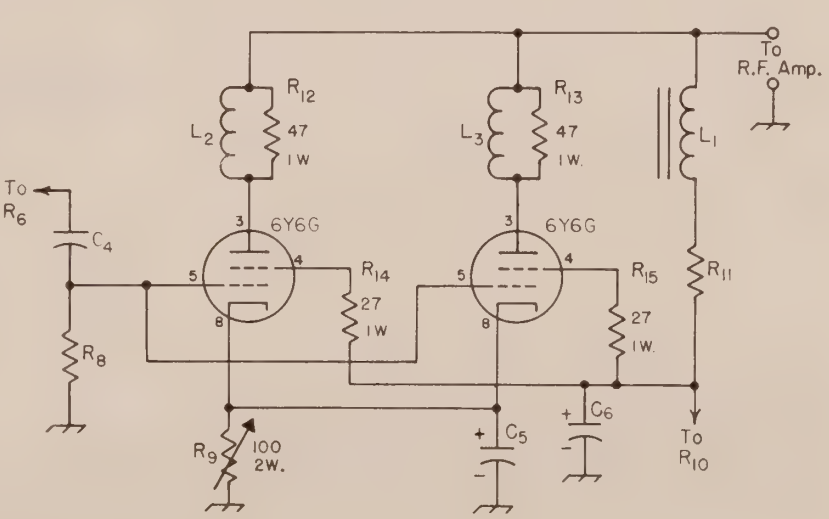


Fig. 4-14—The simple grid modulator circuit used by W8MMK. L_2 and L_3 are each 10 turns of No. 26 enamel wire wound over R_{12} and R_{13}, respectively.

5. Hints and Kinks . . .

for the Power Supply

GROUND AND POLARITY TESTER

In the interest of safety, it is advisable to test all leads to ground (earth) for resistive characteristics. A resistive circuit or lead to ground is not a safe one and may not be depended on as a means of preventing accidental shock.

The simple circuit shown in Fig. 5-1 may be as familiar to many hams as it is new to others,

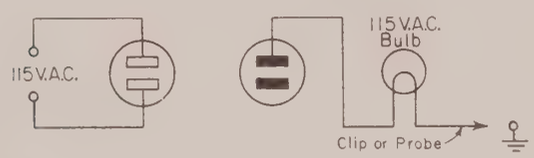


Fig. 5-1—Diagram of the simple ground tester.

but it does provide one of the quickest means of checking the effectiveness of a ground lead. An ordinary lamp bulb of almost any wattage rating is used as the indicator for the tester. One terminal of the bulb is connected to a standard 115-volt plug and the second terminal of the lamp is connected to a heavy clip or probe which in turn is used to make contact with the ground point under test. The bulb will light to full brilliancy when connected between the a.c. line and a good ground point. On the other hand, less than normal brilliancy indicates a poor ground connection.

A second use for the simple circuit is that of testing for either the hot or the grounded side of the a.c. line. The bulb will light when the active side of the plug makes contact with the hot side of the a.c. receptacle and will fail to glow when contact is made with the grounded side of the line.

— *Joseph A. Wright, jr.*

[Editor's Note: Two precautions should be observed when using the lamp-bulb ground tester. When testing the effectiveness of a lead, make sure that the test lamp is lighted to full brilliancy by checking it against a lamp of similar rating that has been plugged into a convenient 115-volt socket. Second, when attempting to determine the polarity of an a.c. outlet, make sure that the test lamp is a good one; remember, a *burned-out lamp won't glow* even when connected to the *hot* side of the line.]

FINDING PORTABLE GENERATOR FREQUENCY

Browsing through old copies of *QST*, I came across an article in the October, 1956 issue, page 39, entitled, "Checking the Frequency of Portable A.C. Generators." Having wrestled with the same problem recently myself, this article interested me, but the author specified one thing that I did not have — commercial power of accurate known frequency. Being located in the southern part of the Philippines, the nearest commercial power of any accuracy was 200 miles away!

I had heard that ordinary electric clock accuracy is controlled by the frequency of the power. If the clock were plugged into a generator with an output frequency of 60 c.p.s., it should keep perfect time. However, if the generator frequency were fast or slow, the clock would gain or lose time. When I want to check the speed of the generator I plug in an electric clock and time the interval for the sweep second hand to make one complete revolution with a stop watch. If it takes over a minute I know the frequency is low, and if it takes less, the generator is running fast. The formula used to find the generator frequency is 3600 divided by the number of seconds for a complete revolution of the clock second hand.

— *John Lawless, W1YEF*

REPAIRING ELECTROLYTIC CAPACITORS HAVING BROKEN LEADS

Many junk-box electrolytic capacitors having broken leads too short to solder to can be salvaged as follows. If the lead has been broken off right at the retaining rivet, pry up the edge of the rivet from where the lead enters to a point 180 degrees around. Then, carefully force a half turn of the broken lead from under the pried-up section of the rivet, thus providing a short stub to which an extension may be soldered. Be sure and leave a full half turn of the old lead clamped under the rivet.

— *Allen Podell, W3WDA*

BLEEDER SAFETY LIGHT

POWER-supply bleeder resistors sometimes do burn out despite conservative ratings. One method of insuring against burnout is to use two bleeders in parallel, each one having a higher value than the original single one. It is rather unlikely that both resistors will open up during the normal life of a power supply.

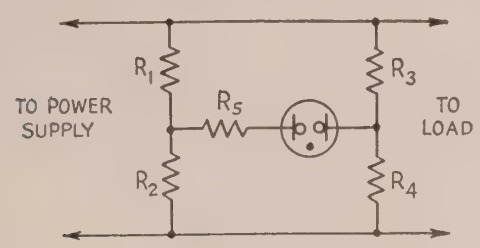


Fig. 5-2—Power supply bleeder circuit with burn-out indicator.

Another solution, shown in Fig. 5-2, gives a visual warning whenever a bleeder resistor opens up. Four resistors, R_1, R_2, R_3, R_4 each of the same resistance but rated one-quarter of the power of a single bleeder resistor, are used in a bridge along with a neon bulb connected between the two junctions. When any one of the four resistors opens up, a voltage difference will appear across the neon bulb, causing it to ignite and thus giving indication of a burnout. In most power supplies, additional current limiting resistance, R_5, will be needed to protect the neon bulb; the value of R_5 can be calculated or found experimentally. If a $\frac{1}{25}$-watt neon bulb is used, try a value around 500,000 ohms for each kilovolt of total power-supply voltage.

— *Harry L. Cox, jr., W3MJC*

USING 115-VOLT AUTOTRANSFORMERS IN 230-VOLT PRIMARY CIRCUITS

MANY amateurs who have graduated from 115-volt primary circuits to the 230-volt system have no doubt wondered how to utilize their 115-volt autotransformer (Variac, Powerstat, etc.) in the new installation.

A simple and practical method of using the 115-volt units for control of primary voltage for 230-volt transformers is shown in Fig. 5-3. The

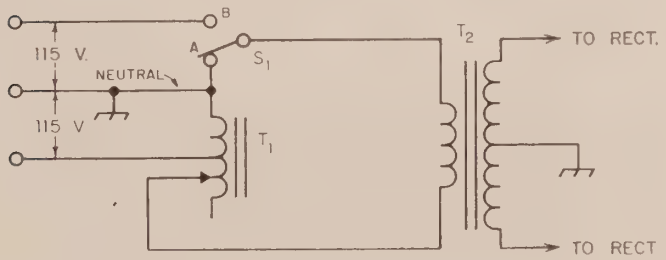


Fig. 5-3—Circuit diagram showing how W7DET controls output from a 230-volt primary circuit with a 115-volt autotransformer. Both the autotransformer, T_1, and the control switch, S_1, must be rated for the current flowing through the primary of the plate transformer, T_2

s.p.d.t. switch, S_1, provides a "two-step" operation. With S_1 in position A, the primary voltage for the power transformer, T_2, may be varied between zero and the upper limit of the autotransformer (usually around 130 volts). With S_1 at position B, the primary voltage may be adjusted from 115 volts to something above 230 volts with the highest voltage again being determined by the capabilities of the autotransformer, T_1.

— *William Vandermay, W7DET*

CONTROLLED CHARGE-UP TIME FOR HIGH-VOLTAGE FILTER CAPACITORS

MANY high-voltage supplies using large values of filter capacitance draw a heavy surge of current from the line and through the rectifiers when the supplies are turned on. Should this condition be serious enough to warrant remedy, it may be almost completely eliminated by installing a simple *time-delay* circuit in the supply.

Fig. 5-4 shows how three time-delay components, C_1, K_1 and R_1, are connected into a typical 1000-volt choke-input supply. For the sake of simplicity in the diagram, the primary windings of the transformers and the control switches are not shown. Notice that R_1 is connected between the plate-transformer (T_1) center tap and ground, and that it is in parallel with the contacts of K_1. K_1 is connected between the bottom end of the bleeder resistor (R_2) and ground and is shunted by the 100-μf. capacitor, C_1.

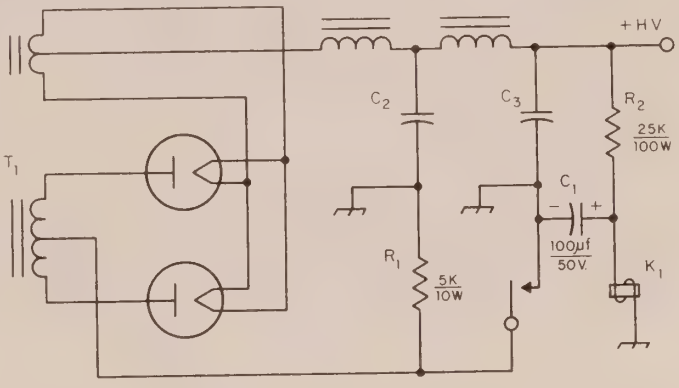


Fig. 5-4—Schematic diagram showing W2LYH's controlled charge-up-time arrangement installed in a typical 1000-volt power supply. K_1 is a s.p.s.t. normally-open relay having a 200-ohm winding.

In operation, K_1 does not close until after the supply has been turned on and C_1 has charged through the bleeder. With the 200-ohm relay and the other supply-components used here at W2LYH, the actual *delay-time* is approximately one half-second. With K_1 open, R_1 is effectively in series with the filter capacitors (C_2 and C_3) and, as a result, the capacitors charge at a relatively slow rate. Just as soon as K_1 closes, the limiting resistor is shorted and the supply is back in normal operation.

— *R. V. McGraw, W2LYH*

CAUTION: The bleeder circuit becomes *inoperative* if the relay winding opens up! — ED.

600–1200-VOLT POWER SUPPLY COMBINATION

While building the "Final Rig" (that's the one that you think will be the last rig you'll ever build since it's going to have everything in

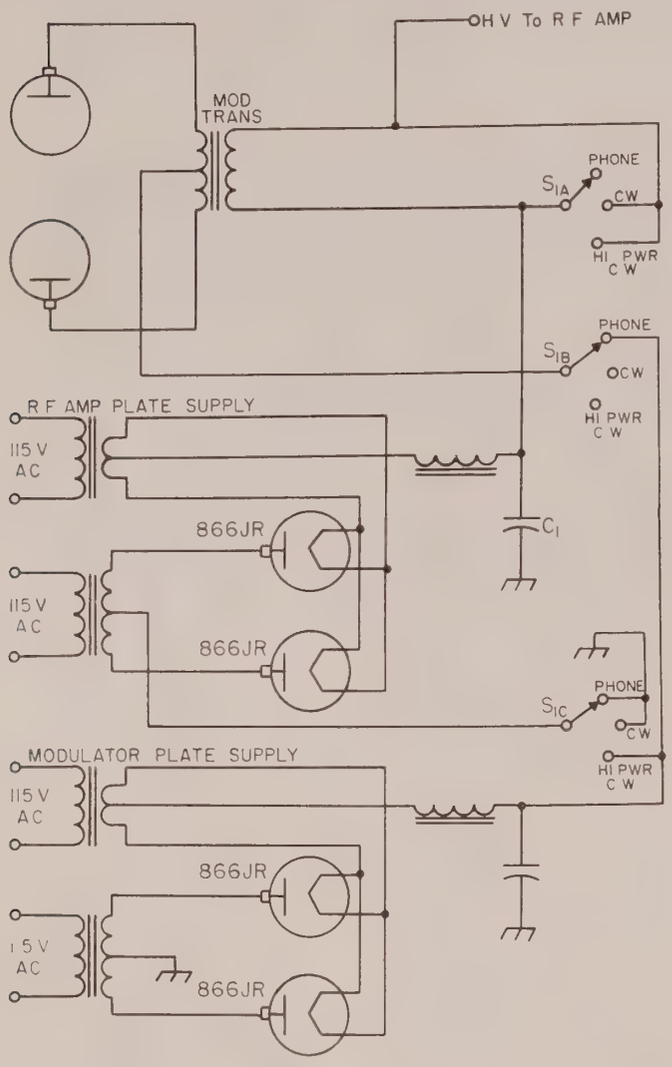


Fig. 5-5—Circuit diagram of the 600–1200-volt power supply. C_1 should be rated at 1500 volts or more. S_1 is a 3-pole 3-position ceramic rotary switch. Power transformer ratings are discussed in the text.

it), I came up with the following gimmick which may be of interest to some rig builders.

Originally I planned to put a pair of 807s or equivalent tubes in the final, and so provided a 600-volt 250-ma. power supply for them. I also planned to use a pair of the same tubes as modulators, and provided a separate 600-volt 250-ma. power supply for them. After both power supplies were installed on the chassis and working, I considered the fact that half of my available d.c. power was unused on c.w. A little thought evolved the circuit shown in Fig. 5-5.

Basically, the control is a 3-pole 3-position switch. In the phone position it runs the r.f. section from one 600-volt supply, and the modulator from the other. In the c.w. position it removes plate power from the modulators and shorts out the secondary of the modulation transformer. In the third position, called hi-power c.w., it places the two 600-volt supplies in series, giving 1200 volts at 250 ma. for the final r.f. section. Ordinary 807s won't take that sort of power so I used a pair of 4-65As. These tubes draw practically the same plate current over a wide range of plate voltages — ratings being 150 ma. each through the 600–1500-volt range. Screen voltage comes from the 250-volt supply used for the exciter and speech-amplifier sections.

— *Howard J. Hanson, W7MRX*

TIME-DELAY PROTECTIVE CIRCUIT FOR HIGH-VOLTAGE POWER SUPPLIES

A well designed power supply using mercury-vapor tubes includes protective circuitry which assures adequate filament warm-up time for the rectifiers. The simple circuit shown in Fig. 5-6 will, with the thermal relay specified, provide a thirty-second delay or warm-up period before the high-voltage transformer is turned. The circuit is used here at VE3AXC with an 866 supply and functions as follows.

When S_1 is closed, 115 volts a.c. is applied to the heater of the thermal relay, K_2, through the normally-closed contacts of K_1. The rectifier-tube filament transformer also receives primary power with the closing of S_1, K_2 closes thirty seconds later and completes the a.c. circuit for the solenoid of K_1. K_1 now closes, feeds power through its normally-open contacts to the primary of the plate transformer, and breaks the 115-volt connection to K_2. The thermal relay cools off and opens, but K_1 remains closed to complete primary wiring for the plate transformer.

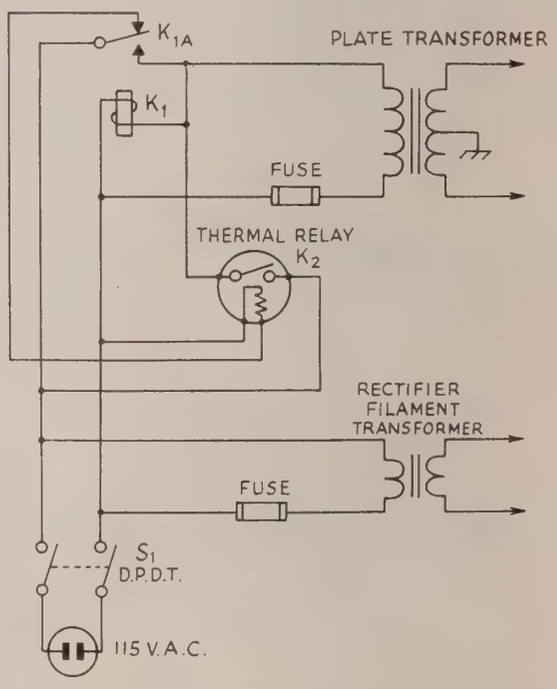


Fig. 5-6—Schematic diagram of VE3AXC's time-delay protective circuit for high-voltage power supplies.
K_1—S.p.s.t. normally-open 115-volt a.c. relay.
K_2—S.p.s.t. normally-open 115-volt a.c. thermostatic delay relay (Amperite 115N030).
S_1—S.p.d.t. power switch.

A break in a.c. primary power (power failure or accidental unplugging of the line cord) will open K_1 and disconnect primary voltage from the plate transformer. When a.c. power is restored the complete cycle of relay operation will repeat itself as long as S_1 is closed.

— *T. R. Baker, VE3AXC*

RELAY POWER SAVER

Most relays require only about ⅓ to ½ the initial closing current to hold them in the closed position. This fact can be used to reduce the size of the relay power supply.

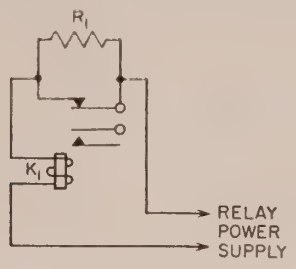


Fig. 5-7—Circuit of the relay power saver.

The circuit in Fig. 5-7 shows a current limiting resistor R_1 across a set of normally-closed contacts on relay K_1. These contacts are adjusted to open when the armature is near the end of its travel. When these contacts open, R_1 is placed in series with the relay coil winding thus reducing the coil current to a lower value.

The resistance of R_1 can be calculated by using Ohm's Law.

— D. C. Mead, K2ZZF

SERIES-PARALLEL SWITCHING CIRCUIT FOR POWER TRANSFORMER PRIMARIES

The use of a d.p.d.t. toggle switch to obtain full or reduced plate voltage from dual-primary types of power supplies may not have occurred to the newly-initiated ham. The writer used the idea with a surplus transformer having dual primaries, and more recently with two identical low-voltage plate transformers of single primary design.

Fig. 5-8 shows how the d.p.d.t. toggle switch, S_1, is wired to provide either series or parallel operation of the primary windings. To avoid

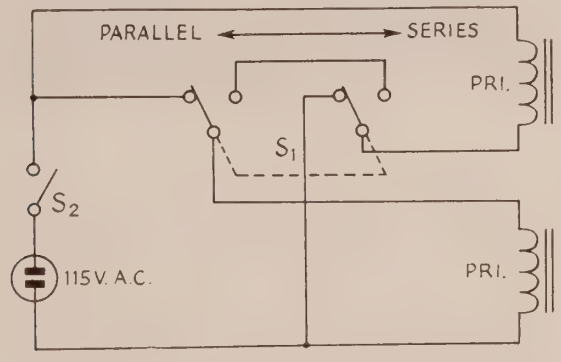


Fig. 5-8—Diagram of the series-parallel switching circuit for plate power transformers. The d.p.d.t. control switch S_1 is shown in the parallel-connection position. S_2 is a conventional on-off switch.

complication in the diagram the secondary circuit is not shown. If two transformers are used in the circuit, the secondary windings should be joined together to form a center tap and then connected to a typical full-wave rectifier system.

— Lyle S. Moyer, VE5LW

Editor's Note: A typical full-wave rectifier circuit will be found in the Power Supply chapter of *The Radio Amateur's Handbook*. The full-wave center-tap rectifier section of the *Handbook* also advises concerning polarity and ratings which must be observed when two transformers are connected in series to provide a center-tapped secondary winding.

ADDITIONAL OUTPUT TERMINALS FOR THE RECEIVER'S AUXILIARY POWER SOCKET

In this day of many accessories to communications receivers, it is frequently desirable to connect more than one low-current accessory to the auxiliary power socket of the receiver. Fig. 5-9 shows an open-for-inspection view of a dual output connector that combines the plug-in feature with clean-cut construction.

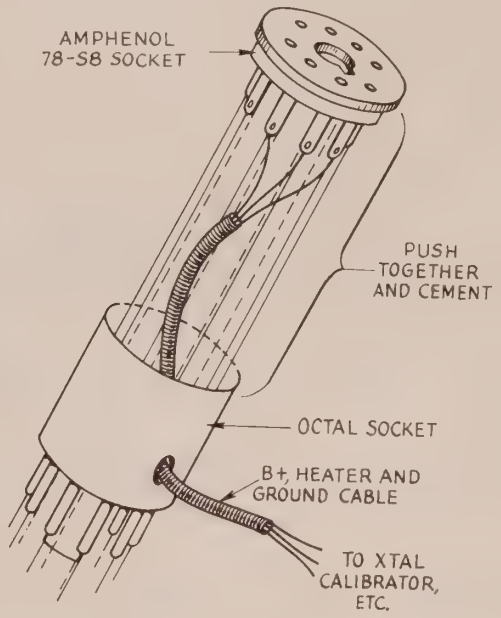


Fig. 5-9—Sketch showing construction of the dual output connector for use with a receiver's auxiliary power socket. The idea can be extended to accommodate more than two accessories providing that the receiver power supply can safely deliver the extra current.

Drill a ¼-inch hole in the side of a salvaged octal tube base that has been cleaned free of cement and anode leads. Feed the power cable for one of the accessories through the hole in the side of the base, and then connect the individual leads of the cable to the terminals of an Amphenol type 78-S8 socket. Before soldering at the socket terminals, provide short bare wire jumpers for connection between the socket and the base. Pass the jumpers down through the prongs in the base, making sure that the guide slot in the socket is properly orientated with respect to the guide pin on the base. Press the socket down onto the base after applying cement where required. Clip the wires extending through the base prongs and solder.

A little thought as to the direction in which the accessory cable should extend from the assembly, given at the time the hole is drilled, will add to the neatness of the unit. Eyes may be protected while salvaging the base of a glass tube by putting the envelope in an empty cigarette package or other recovering while the glass is smashed.

— Thomas B. Hedges, W3BKE

POWER-SUPPLY HINT

When a tube such as the 807 is used, it is frequently desirable either to increase or reduce the power-supply output voltage, depending on the mode of operation — phone or c.w. If the power transformer is one designed for two levels of output voltage, the change from high to a low voltage, or vice versa, can be made quickly and inexpensively by employing the circuit shown in Fig. 5-10. This particular supply will deliver either 600 or 750 volts d.c. and selection of the desired voltage is made by inserting the Type 5R4GY rectifier either in the left- or right-hand socket.

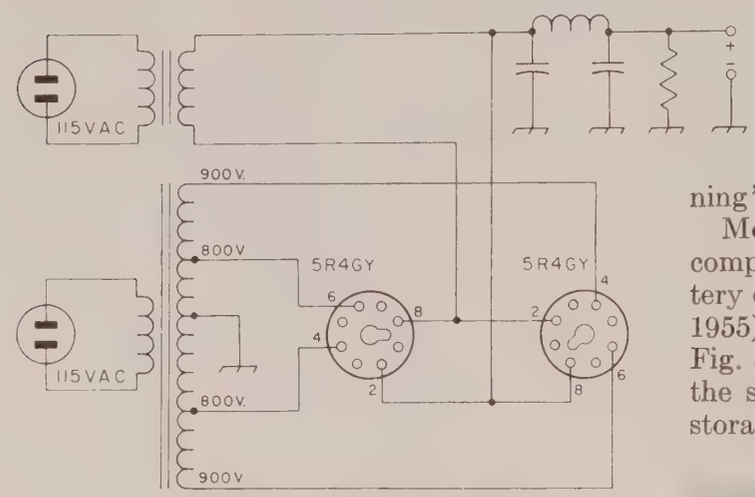


Fig. 5-10—Simple method of selecting voltage output from dual-type power transformers.

Thus, the cost of an expensive well-insulated high-voltage switch is replaced by the small expenditure for an additional tube socket.

Caution: Be sure power is off and filter discharged! — *Gerald L. Collins, W4ZPX*

NOVEL REGULATOR

Regulator tubes can't be paralleled directly to obtain greater current capacity because one tube will always ionize at a slightly lower voltage, thus preventing the other tube from firing.

The diagram in Fig. 5-11 shows how parallel operation of VR75s may be used without the usual equalizing resistors in series with each tube.

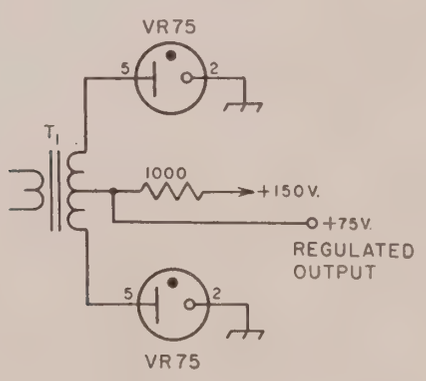


Fig. 5-11—WØDYW's voltage regulator.

The transformer T_1 can be any universal output transformer having a center-tapped primary. The secondary winding is not used. The d.c. resistance of the transformer winding is sufficient to accommodate the slight difference in operating potential of the two VR tubes.

— *W. E. Witte, WØDYW*

A "FIXED-LOCATION" POWER SUPPLY FOR MOBILE EQUIPMENT

Mobile equipment permanently mounted in a car can usually be operated "fixed location" for extended periods of time only at the expense of either an overheated engine or a run down battery. And, of course, gallons of gasoline can be consumed while the car motor is being used to generate primary power for the mobile supply. If operation takes place during a hot afternoon, you're also in for some personal discomfort caused by the extra heat radiated from the motor. Ignition noise generated by your own car is still another annoyance that results from "leave-your-motor-running" operation.

Most of these problems may be miminized or completely eliminated by using a field-type battery charger as suggested by W7FVI (*QST*, July, 1955). Our version of this supply, shown here as Fig. 5-12, is used to charge the car battery, but the same unit may be used to keep life in any storage battery being used in the field.

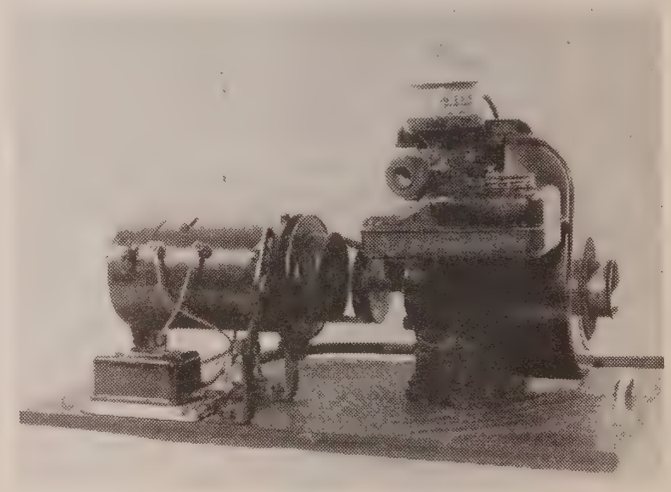


Fig. 5-12—W9WTY's version of the field-type battery charger described previously by W7FVI. This particular unit is used to charge the car battery during extended periods of car-not-in-motion mobile operation.

The charger consists of a small gasoline engine, an old auto generator and a voltage regulator. These are mounted on a plywood base equipped with handles. Output from the generator is coupled to the car battery through a long length of heavy duty two-wire cable. Naturally, the length of the cable will be determined by how much you want to separate the charger and the battery. If you want lots of separation so that racket from the charger can be kept in the background as much as possible, just remember that the cable may have to carry 30 amperes or more if the generator-battery system is designed for 6 volts. Figure on a wire size that will handle 15 or 20 amperes if the charger is a 12-volt affair.

— *Jack Miller, W9WTY*

SWITCH-TO-SAFETY IDEA

HAVING in mind the worthwhile purpose of increasing the longevity of ARRL members and other amateurs, I would like to add a suggestion to the several technical Switch-to-Safety items which have appeared in *QST*. Fig. 5-13 illustrates a simple power wiring arrangement which provides continuous safety checks on power and ground connections. With this arrangement, all switches and fuses are located in the "hot" side of the 117 volt a.c. line, carrying through the scheme used in standard house wiring. (When fuses are installed in both sides of the line, it is possible for the cold fuse to operate from overload and still leave equipment and wiring energized with 117 volts with respect to ground.)

One side of a neon panel light is connected to the "hot" side of the a.c. line after the fuse and main power switch. The other side is connected to station equipment cabinet ground through a 50,000 ohm resistor. A standard bayonet panel socket with a clear glass jewel is used for lamp (NE-51) installation. Before connecting the power plug to an outlet, the main power switch, S_1, is placed in the off position. Some resistive load normally connected after the main power switch should be present. This fixed load may be provided by a desk lamp and a receiver.

If the NE-51 illuminates when the power plug is inserted in an outlet, reversed polarity is indicated. The NE-51 will then go out if the main power switch, S_1, is placed to on. Reversing the power plug will result in opposite- and proper-operation of the panel light. It will illuminate only with the main switch on. Failure of the light to glow with either position of the power plug indicates an absence of the vital connection between chassis and actual ground (shown as heavy line in Fig. 5-13). With the power plug properly installed, all station equipment is completely de-energized by operation of the main switch or fuse. Improper installation of the plug is immediately apparent from the appearance of the neon lamp.

In addition to the main power switch, S_1, the circuit includes S_2 and S_3 for control of the filament and plate supplies, respectively. Of course, S_2 and S_3 may be used to control additional transformers provided these are properly connected in parallel with the primaries of T_1 and T_2. Ratings shown for fuses F_1, F_2 and F_3 may be varied to suit individual requirements.

— *John W. Browning, W8DDF*

INEXPENSIVE CIRCUIT BREAKER

A MODEL railroad item which may have some utility for builders of ham gear is a 3-amp. thermal-type circuit breaker, also called a "grasshopper." It resembles a small fuse, and consists of a cartridge about one inch long which mounts on fuse clips which are supplied with the device. A bimetallic strip on top heats up on overload, springing up and breaking the circuit; the strip is pushed back into place to reset.

The circuit breaker's strong points are its small size, low cost (about 50 cents complete with clips and mounting screws) and simplicity of mounting. It also does away with the need for replacing fuses which blow on week ends when the radio stores are closed. Chief disadvantage is its slow action; the strip must heat up before it opens, and it must cool off before it can be reset. Also, the voltage appears across the exposed ends, so if the circuit breaker is mounted on a panel, for which it was apparently designed, it should be provided with an insulated cover. It also places some resistance in the circuit.

It is available in most hobby shops as the Mantua Metal Products Co. Kit No. 708.

— *Julian N. Jablin, W2QPQ*

CONVERTING FILAMENT TRANSFORMERS FOR PLATE-SUPPLY USE

IN searching for miniature power transformers for such low-power items as grid-dip oscillators, etc., I have found it convenient to make my own, using small filament transformers. Since most of these have the low-voltage winding wound on the outside, it is easy to remove the few filament turns to make room for the rewinding.

The procedure is simple. Count the turns removed to determine the turns-per-volt ratio for the core. Now rewind the filament turns with a smaller size wire. Follow this with the "high-voltage" winding using the number of turns per volt previously determined. The wire sizes should be chosen so the I^2R losses in the two secondaries under load do not exceed the rated I^2R loss for the removed turns. This allowable loss is fairly flexible and can be exceeded by 50 per cent or so for intermittent duty or where some ventilation is present.

— *Ben Vester, W3TLN*

[EDITOR'S NOTE: Additional data pertaining to the rewinding of transformers will be found in Chapter 7 of *The Radio Amateur's Handbook.*]

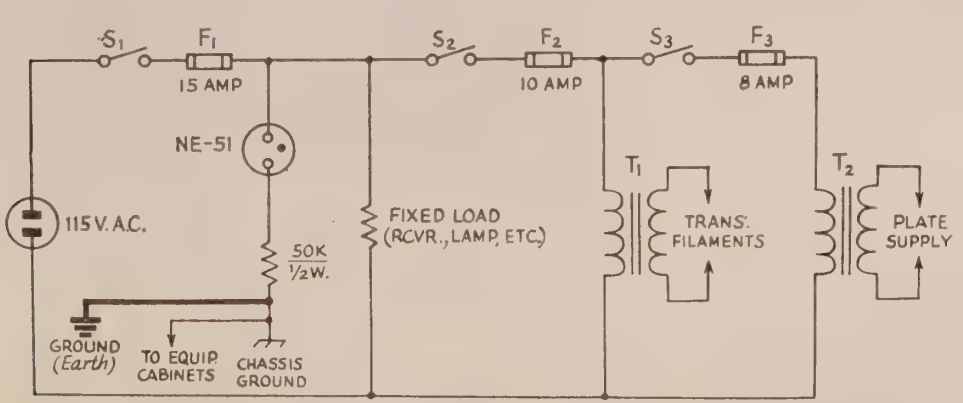


Fig. 5-13—Diagram of W8DDF's switch-to-safety power control circuit.
F_1, F_2, F_3—Line fuses; see text.
S_1, S_2, S_3—S.p.s.t. power switches.
T_1, T_2—Filament and plate transformers.

STATION CONTROL CIRCUIT

A NOVEL method of switching line and plate voltages is shown in Fig. 5-14. Two momentary contact switches, S_1 S_2, are used, one being of the normally open type, the other a normally closed type. The relay is of the d.p.s.t. variety. One pair of contacts is used as holding contacts, while the other pair is used to break the circuit.

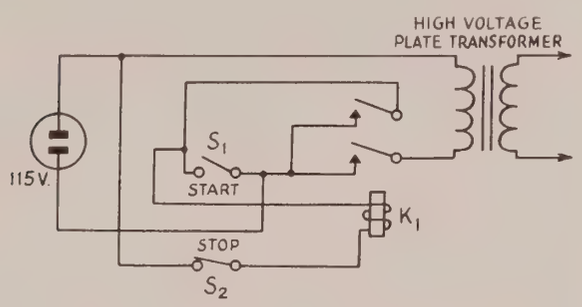


Fig. 5-14—Diagram of the control circuit.

S_1—S.p.s.t. normally open switch.
S_2—S.p.s.t. normally closed switch.
K_1—D.p.s.t. relay normally open.

This method is often used in commercial broadcast equipment, and is especially useful for remote control applications. The switches can be color coded to show their functions; red and green seem to be appropriate colors for start-stop and on-off. — *Earl A. Carron, jr., W1WRW*

SCREEN-GRID PROTECTION WITH A SURPLUS RELAY

WHILE overload relays operating in the region of 100 to 500 ma. are readily available, it may be difficult to locate one suited for use in the screen-grid circuit of an r.f. amplifier which employs a tube such as the 4X250B. The requirements in this case call for a relay that will disconnect screen voltage at a screen current of 50 ma. or somewhat less.

Use of an inexpensive surplus relay of the dual-winding type provides a simple solution to the problem. Fig. 5-15 is the diagram of a relay-type protective circuit that was whipped up and placed in operation in less than one evening. Although no new principle is involved, the system does provide dependable protection for those expensive pentode and tetrode tubes which ruin so easily because of excessive screen dissipation.

The s.p.d.t. surplus relay has a pair of 200-ohm windings on a common core. One of these windings is connected in series with the screen-grid lead, the normally-closed contacts of the relay and the line from the screen supply. The path between supply and screen grid remains closed until a predetermined value of screen current activates the relay and opens the normally-closed contacts. When the relay is tripped by overload current, voltage is transferred to the second winding which now receives voltage through the normally-open contacts and R_1. The second coil will hold the screen circuit "open" until the relay is re-triggered by the opening of reset switch S_1.

R_2 is a sensitivity control for the relay and, in the original circuit, is adjusted so that the relay kicks over at screen current in excess of 35 ma. Of course, any abnormal operating condition that usually causes excessive screen current will operate the relay.

Reverse the leads to one of the windings if the relay chatters or fails to hold when activated by screen current. If the relay has a spare set of contacts, these may be used to control a "screen-on — screen-off" pilot lamp.

— *I. S. Simpson, W1FYN*

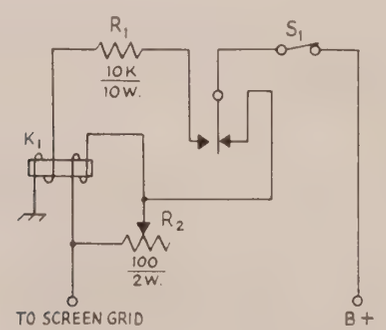


Fig. 5-15—Diagram of W1FYN's, screen-grid protective circuit.

K_1—Surplus relay; see text.
R_1, R_2—See text.
S_1—S.p.s.t. toggle switch.

THE "A.C. VARIVOLTER"

MOST experimentally-inclined hams will agree that the compact type 10 Powerstat (Superior Electric Co.) variable autotransformer, which gives a range of voltages all the way from 0 to 132 volts, is a mighty handy device to have around. As purchased, however, it is unmounted, which makes it rather awkward to use. Maximum convenience, as well as maximum performance of the unit, may be easily obtained by mounting the Powerstat in a 4 × 5 × 6-inch aluminum box with an ON-OFF switch, a 0-150 a.c. voltmeter, a chassis type outlet and a pair of binding posts.

An assembly as described is shown in Fig. 5-16. Decals are used to label the controls, and the handle at the top of the box is an ordinary screen-door pull.

— *Frank H. Tooker*

Fig. 5-16—Front view of the "A.C. Vari-volter." The bakelite binding post must be well insulated from the panel.

IMPROVED BLEEDER CIRCUIT

THE arrangement shown in Fig. 5-17 provides a warning *before* the bleeder resistance burns out, and also a voltmeter for the output of a power supply.

The normal bleeder resistance is made up of two branches in parallel, each branch having

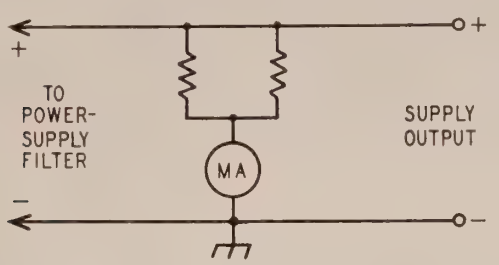


Fig. 5-17—Schematic of the improved bleeder circuit.

twice the resistance of the normal bleeder. A milliammeter connected in the common negative leads reads the normal bleeder current. If one branch of the bleeder opens up, the other branch will still discharge the filter capacitors, but the meter reading will fall to half its original value, warning the operator that one branch has burned out and should be replaced as soon as possible.

If the branches are made of equal resistance, each branch of the bleeder can have half the power rating of the normal bleeder. If, for example, the normal bleeder resistance is 25,000 ohms, 50 watts, each branch can be 50,000 ohms, 25 watts.

The output voltage of the supply can, of course, be determined easily by multiplying the current indicated by the milliammeter and the bleeder resistance in series with it. When the branches are equal, this resistance will be half the resistance of either branch.

Any milliammeter will read directly in voltage if the bleeder resistance is 10,000 ohms, or 100,000 ohms, the voltage being 10 or 100 times, respectively, the reading in milliamperes. A 25-ma. meter, for instance, will read 250 volts full scale with a 10,000-ohm bleeder, or 2500 volts with a 100,000-ohm bleeder.

— *Rev. Joseph A. Terstegge, W9LQE*

Caution: The bleeder circuit becomes inoperative if the meter opens up! — ED.

IMPROVING THE "IMPROVED" BLEEDER CIRCUIT

THE one objection to W9LQE's improved bleeder circuit is that the bleeder becomes inoperative in the event that the meter opens up. This possibility can be avoided by borrowing a trick employed in the metering circuits of some commercial transmitters. The use of one additional resistor, R_3 of Fig. 5-18, does the trick.

The resistance of R_3 should be high enough to prevent any practical effect on the calibration of the meter. The wattage rating of the resistor

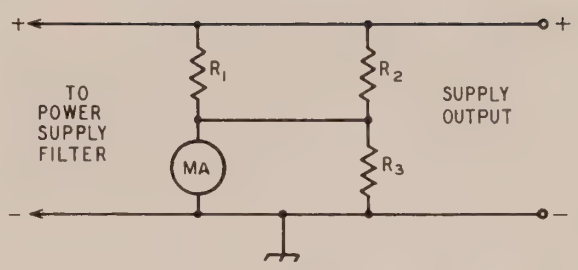


Fig. 5-18—The addition of R_3 to the original "Improved Bleeder Circuit" provides additional protection.

must be in keeping with the power to be dissipated in the event of meter failure.

— *Neil Johnson, W2OLU*

HANDY SOURCE OF POWER FOR D.C. RELAYS

DISCARDED pinball machines, old juke boxes and ARC-5 gear are just several sources of excellent d.c. relays. All too often, though, this type of relay is passed over by amateurs because of the d.c. power requirements. However, it is *not* necessary to provide a special d.c. pack for this type of relay and the following explains how relay power is obtained by several of us fellows up here in W8-land.

Here at W8NOH, we connect the d.c. relays in series with the center tap of a low-voltage plate supply. Not only does this method of connection provide relay power, but it provides a source of negative voltage that may be filtered and used as fixed bias for a keyed c.w. stage. Approximately 18 volts was developed across one of the relays so connected and about −35 volts was obtained across the windings of a pair of relays connected in series. In each case, adequate filtering was provided by an 8-μf. capacitor. Naturally, the relays contacts may be employed for a variety of switching operations such as the control of other supplies, receiver muting, antenna changeover, shorting of a modulation transformer, etc.

W8PUV has a d.c. relay connected in the grid-circuit return of his final amplifier. With the relay contacts controlling the screen and the plate supplies for the stage, it is impossible to apply power without first having excitation available.

W8GJS uses a d.c. relay in the negative return of his plate supply to control a red *warning* light.

Of course, with the relay connected in series with the center tap of the supply, the voltage developed across the solenoid must be subtracted from the original effective value of plate voltage. In other words, if you pick up −18 or −20 volts of bias, you lose that amount at the positive output terminal of the supply.

—*Louis A. Gerbert, W8NOH*

[EDITOR'S NOTE: When using this system, it is advisable to study the current handling capability of the relay winding, remembering that the solenoid must pass the full-load current of the supply. Furthermore, this method of developing bias should be installed only when the supply load is reasonably constant. Serious fluctuations in bias voltage would result if, for instance, a relay was so installed in a supply delivering power for a Class B audio stage.]

LOW-VOLTAGE REGULATION

IF it is desired to obtain low voltages with good regulation, voltage-regulator tubes connected in a differential circuit, as shown in Fig. 5-19, can be used to yield a good many values of output

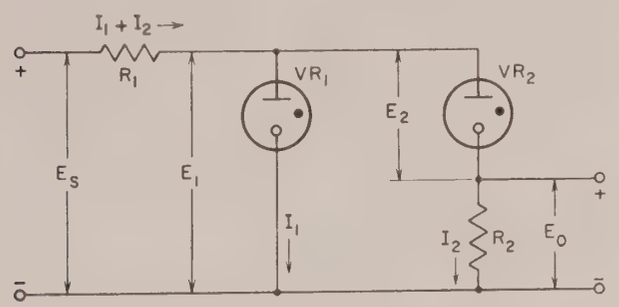


Fig. 5-19—Circuit diagram of the low-voltage regulation system.

voltage. The output voltage E_O is the difference between two regulated voltages and, as such, possesses fairly good regulation. General design equations are given so that resistor values may be determined in terms of supply voltage, rated tube-voltage drops, and permissible tube currents:

$$R_1 = \frac{E_s - E_1}{I_1 + I_2}$$

$$R_2 = \frac{E_1 - E_2}{I_2}$$

E_s = source voltage;
E_1 = rated voltage drop across R_1;
E_2 = rated voltage drop across R_2; and
I_1, I_2 = currents in VR_1 and VR_2, respectively, under no-load conditions.

I_1 should be in the vicinity of 20–40 ma., as in the case of orthodox regulator circuits. I_2 should be about the same for bias circuits where grid current is involved; however, if used only to feed a resistive load, I_2 may be the minimum current necessary to keep VR_2 ionized (about 5 ma.).

E_o is the difference between the rated operating voltages of VR_1 and VR_2, and utilizing Type 0A2, 0B2, 0A3 (VR-75), 0B3 (VR-90), 0C3 (VR105) and 0D3 (VR-150) tubes in correct combinations will yield the following voltages: 3, 15, 18, 30, 33, 42, 45 and 60 volts. Other voltage combinations may be derived if desired by substituting two or more VR tubes in series for VR_1 and VR_2; however, this results in bulkier equipment, and may prove economically unfeasible.

The writer is using this circuit to furnish 42 volts of regulated bias to a pair of 807 modulators. In this case, VR_1 is an 0A2, VR_2 an 0B2, R_1 is 1000 ohms, 10 watts, and R_2 is 1500 ohms, 2 watts. Supply voltage E_s is about 200 volts, and I_1 and I_2 are calculated as 23 and 28 ma., respectively.

— James Fernane, WØJOP

OUTBOARD VOLTAGE REGULATOR

MANY hams would like to have a source of regulated voltage for experimental use, but do not care to tie up a transformer and the necessary filter components in a supply that will be employed only at irregular intervals. The late W5LS designed an *outboard regulator* that may be used with any small power supply capable of delivering up to 100 ma. at 350 to 400 volts.

The circuit diagram of the regulator is shown in Fig. 5-20. Tests of the circuit, made with the output control, R_1, adjusted for an output of 225 volts, showed no voltage drop at loads as high as 77 ma. When adjusted for an output of 250 volts, the regulation was constant up to loads of 60 ma. and a drop of no more than 5 volts was measured with the load increased to 77 ma. At 275 volts, the output remained steady with leads up to 54 ma. and fell to approximately 240 volts with the drain raised to 77 ma.

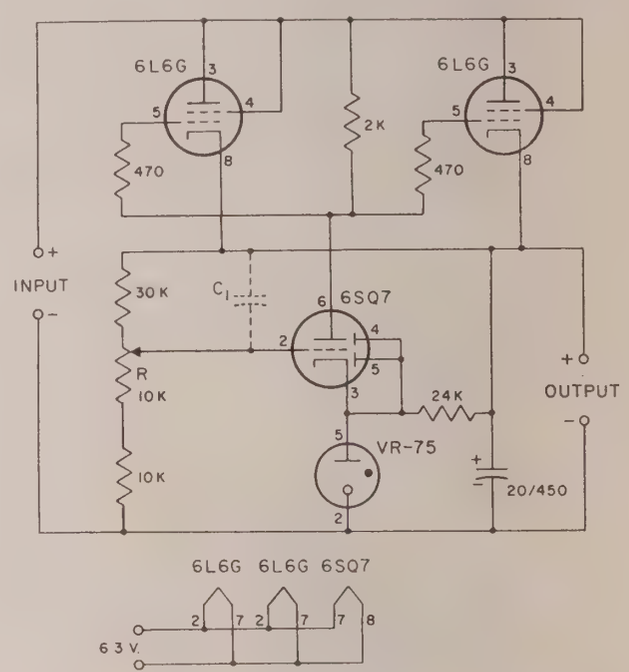


Fig. 5-20—Circuit diagram of the voltage regulator. All resistors, except R_1, 1-watt carbon.
C_1—Optional ripple filter, 0.1 μf., 600 volts.
R_1—10,000-ohm 3-watt wire-wound potentiometer (Clarostat Series 58).

Variations in the design to meet special conditions are possible. In addition to the ripple filter shown, the connection of a 0.002-μμf. mica capacitor across the VR-75 will reduce the noise amplification, in which case the 20-μf. capacitor can be eliminated. Of course, the filament voltage applied to the regulator tubes cannot be used for equipment powered by the regulator unit.

—E. P. Prass, W5AFL

6. Hints and Kinks . . .

for Keying and Monitoring

A NEON-TUBE KEYING MONITOR

While the use of a neon bulb as an r.f. indicator is well known, and its properties as a discharge device have been used in many ways, it may not be generally appreciated that it may also be used as a relay. This application is based on the fact that the gas in the bulb becomes conductive when it is ionized, not only when a suitable voltage is applied to the electrodes, but also when the bulb is located in a strong r.f. field. In the latter case, the bulb can act as a relay, controlling the flow of current in an external circuit when ionized by proximity to an r.f. field. This characteristic makes possible the construction of a very simple keying monitor as shown in Fig. 6-1.

In Fig. 6-1, V_1 is a neon bulb located near the final tank, an antenna wire, or wherever the r.f. field is strong enough to ionize completely the gas in the bulb as evidenced by a strong glow.

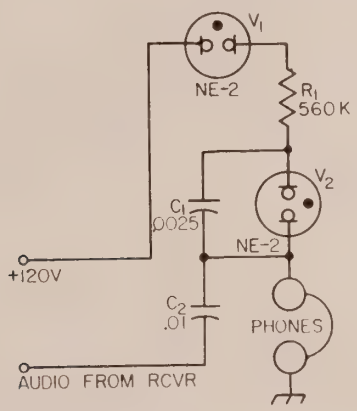


Fig. 6-1 — Circuit diagram of the neon-tube keying monitor. C_2 is a coupling capacitor for the audio output from the receiver. V_1 and V_2 are 1/25-watt neon bulbs. GE type NE-2. Other component values are discussed in the text.

Incidentally, it is better to keep the bulb out of the field of the tank coil itself to minimize any possible r.f. pick-up on the leads. A suitable location would be adjacent to the stator plates of the tank capacitor, being sure that all leads are well insulated against direct contact. No perceptible detuning of the tank should result, and the power absorbed by the device is negligible. As a further precaution against any unwanted radiation, the leads to the relay bulb should be shielded. They may, however, be as long as necessary.

The rest of the circuit is the familiar neon-bulb audio oscillator connected in series with the headphones. The values of R_1 and C_1 will determine the frequency of the tone generated. The values shown will give about an 800-cycle note, and provide a comfortable volume in high-impedance headphones. If greater volume is desired, the ratio of C_1 to R_1 should be increased. Increasing C_1 alone, of course, will lower the frequency, so that for the same audio frequency, R_1 must be reduced as C_1 is increased.

There are a few precautions to be observed in building the monitor. If the voltage is too high, it may be found that the oscillator continues to operate after the key is released. If the voltage is too low, the neon bulb may not strike. Also, the voltage source should be well regulated, as otherwise a most annoying chirp will result. For this reason, as well as for convenience in construction, the use of a bleeder across the receiver power supply will usually be most satisfactory. Since very little current is drawn, a high-resistance bleeder can be used. In the version at WØSOL the source is the junction of two 100K resistors across the 240-volt receiver power supply.

The components of the audio oscillator are small and can be located wherever convenient, either within the receiver, if space permits, or in an external match-box-size housing, or even simply wired together and taped to the leads to the relay bulb.

— *Preston B. Tanner, WØSOL*

SIMPLE KEYING MONITOR

If the keying circuit uses a low-voltage relay, and if you want a simple means of following your own fist, try hooking an ordinary buzzer in series with the line to the relay. The stunt has been used here at W4TP for about 15 years. The buzzer requires adjustment and the tone emitted, with 6 volts a.c. applied to the sounder, is a not unpleasing T6.

— *Hugh W. Holt, W4TP*

THE "SIAMESE PADDLE"

ALMOST anyone who has built an electronic keyer has gone through the experience of discovering, usually after completing the electronic part, that the control mechanism — the switch, or key — can be much more of a problem. A glance at the circuit of one of these devices fails to show why an old hack-saw blade wouldn't do the trick. But this is far from the truth. Positive and reliable control requires a considerable degree of mechanical refinement, as attested by the fact that a ham will often chop up a twenty-dollar bug to get the few essential parts he needs. Satisfactory homemade substitutes require greater than an ordinary amount of skill with tools.

However, I recently discovered that there is a very simple solution to the problem. A pair of ordinary inexpensive straight keys can be made into a de luxe keyer control in less than an hour, if you don't insist on trimming it up. It not only supplies a good wobble-free mechanism, but it also provides for convenient adjustment of tension and contact spacing, satisfying the most finicky operator.

As Fig. 6-2 shows, it is simply a matter of mounting the two keys back to back in a vertical position. The keys shown in the photograph are Type J-38, selling in surplus for as low as 85 cents each, although almost any other type can be adapted. The J-38s are particularly suitable because they come mounted on bakelite bases, one of which can be put to use since most electronic-keyer circuits require insulation for all three terminals of the control.

First remove the two keys from their bases, strip one of the bases of the remaining hardware and remove the shorting levers from both keys. It may be necessary to lift the key arm out of its bearings to get at the screw holding the lever. Now place the keys on edge, with their bottoms facing, and clamp them together with a 6-32 machine screw through the upper mounting-screw hole. Using another 6-32 screw through the lower mounting hole, fasten a 1-inch hardware-store angle piece on each side with the legs extending outward. (The brass-plated pieces usually found in hardware stores, but less often in dime stores, make a much neater job than the common iron variety.) Make sure that the strap connecting the stationary key contact to its terminal doesn't short-circuit against the angle piece.

The front end of the assembly is supported on 1½-inch hardware-store angle pieces. One leg of each of the two pieces is shortened by cutting it off about midway between the two holes. One of these angle pieces is then fastened to the lower terminal of each key, using the terminal cap screw through the top hole in the longer leg of the angle piece. The short legs should point inward.

One of the J-38 bakelite bases is then marked and drilled to fit the holes in the feet of the mounting angles. The key should be placed with the feet centered on the base. The holes should be well countersunk underneath so that flat-head mounting screws do not protrude.

The paddles are made of pieces of ⅛-inch polystyrene or lucite sheet, 2½ inches long and 1 inch wide. A hole to pass a machine screw that fits the knob hole in the key arm is drilled in each paddle, ½ inch from one end. Most key knobs have a standard 8-32 thread. The exact manner of mounting the paddles depends on factors to be discussed presently.

If you can locate a piece of ½-inch steel or brass, you can add a weighting base with rubber feet like the conventional bug. The base shown is 6 inches long and 3 inches wide. Be sure that the mounting screws on the underside of the bakelite base don't protrude so as to short on the metal base. If the weighting base is omitted, the key can be screwed or cemented to the operating table. Rubber cement sets quickly and yet permits removal without difficulty. Also, it will not mar the finish of an operating table.

The adjustment of the key depends largely on the personal preferences of the operator. I have mine adjusted so that both sets of contacts cannot be closed simultaneously. However, many of those who are using electronic keyers of the self-completing type find possible many short-cuts in the forming of certain characters and increased ease of handling in other ways if it is possible to close both circuits at once when desired. For instance, closing the dot side while dashes are being sent does not interfere with the sending of dashes. Therefore, when both sides are closed, the change-over from dashes to dots can be accomplished merely by opening the dash side.

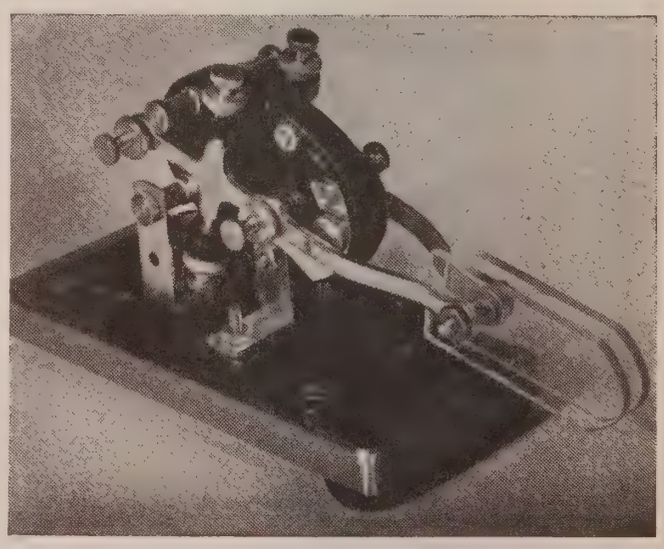


Fig. 6-2—By simply mounting two standard keys back to back in this fashion you can have a de luxe control for an electronic keyer in less time than it takes to tell about it.

Actually, it is necessary to open the dot side only for spaces.

As shown in the photograph, the paddles are mounted on the inward sides of the key levers, with the heads of the 8-32 screws also on the inside. With this arrangement, it may be necessary to bend the key levers slightly if it is desired to prevent closing both circuits at the same time. Place a thickness or two of paper between the

contacts of each key and press the two paddles together between the thumb and forefinger. Then bend the levers slightly so that when the paper is pinched securely between both sets of contacts, the heads of the screws are in contact.

After the photograph was made, an arrangement making this adjustment more convenient was found. The paddles were placed on the outer side of the key levers and the screws were reversed with the heads on the outside. A locknut was first run onto each screw. Then the screw was passed through the paddle, threaded into the key lever, and then fastened with another locknut on the inside. Now the above adjustment can be made simply by adjusting the screws with a screwdriver and locking with the two nuts. I prefer the wider paddle spacing that results with this arrangement, although others may prefer the closer spacing when the paddles are on the inside. It will usually be possible to use the screwdriver adjustment, even with the paddles on the inside, although it may be necessary to file the nuts down to fit the space between the key levers.

If simultaneous closing of both sides of the circuit is desired, adjustment is merely a matter of setting the contact spacing, bearing play and spring tension to suit the operator, using the adjusting screws already provided on the keys for these purposes. If you have a light touch, it may be necessary to change the springs to lighter ones, or to cut a turn or two off the existing springs and stretch to fit the space.

In the electronic-keyer circuit, the "arm" connection will be made to one of the terminals connected to the frames of the keys, while the two "side"-contact connections will be made to the terminals connected to the straps leading to the stationary contacts. Depending upon how these two "side" contacts are connected, the keyer can be operated either right-handed or left-handed. Simply reversing these connections reverses the operation.

— *Myron Hexter, W9FKC*

CONVERTING THE "SIAMESE PADDLE" FOR BUG-TYPE OPERATION

THE simple and inexpensive keying mechanism, "The Siamese Paddle," described above, can be converted to a first-class bug with a minimum of additional cost and effort. The simple modification which provides for bug-type operation of the key is shown herewith as Fig. 6-3.

The vibrating arm for the bug is made from a hack-saw blade or a length of spring steel. A hole drilled in the front end of the arm allows it to be attached to the *dot* lever of the Siamese Paddle by means of the original spacing adjustment screw. A homemade spring contact is soldered to the vibrating arm as shown in the drawing. In a fancier version of the bug, this contact could be made adjustable along the arm. The stationary contact and the contact adjustment for the dot arm may be made from a binding post and a 6–32 machine screw.

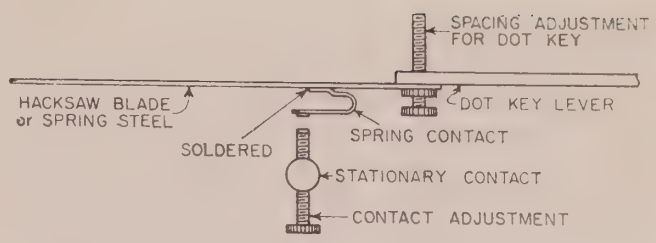


Fig. 6-3—A simple system for converting the "Siamese Paddle" to a bug.

The vibrating arm for the key must be weighted down to slow the dot rate down to a reasonable speed. This may be accomplished by wrapping wire-type solder around the arm. An ordinary clothespin will serve the same purpose for some speeds of operation.

Because the two levers of the bug are not mechanically linked, it is possible to strike a dash character before a dot action has been overcome. However, this tendency can easily be avoided after a little practice.

— *Jack Gjovaag, W7UKI*

WEIGHTED KEY BASE

BY using a clean 3 × 4-inch sardine can as a mold, lead can be formed into a neat, easily worked key base. Lead may be obtained from a local tire station that does wheel balancing, from fish-line sinkers, or it may be purchased in bar form at a plumbing supply house.

An ordinary kitchen range will provide heat for melting the lead. Use enough material to fill the can to a depth of ¾ inch (after it has become molten). After the lead has melted, push the topside film to one side and remove with pliers. Then remove the mold from the range, allow a brief period for the lead to set, and then speed the cooling process with the aid of cold water.

Countersink the holes for the flat-head bolts used to hold base and key together. A strip of felt glued to the bottom of the base will prevent scratching of the operating table.

— *John C. Hemby, W5WQQ*

ANOTHER ANTI-SKID TREATMENT FOR BUGS

DURING a three-week hiking expedition I came across the ultimate answer to the problem of sliding bugs. Dr. Scholl's Adhesive Foam, used to prevent blisters, is available from most drugstores at low cost. These foam-rubber pads are 3/16-inch thick by 6 inches square and have a layer of adhesive on one side, and a protective gauze covering on the other side.

The foam is cut into ¾-inch squares, the protective gauze removed, and pressed onto the rubber mounting feet of the bug. The feet (of the bug, of course) should be free of dirt and perhaps roughly filed to make a better sticking surface for the Adhesive Foam. The foam pads will hold best on a smooth hard surface such as a table top.

— *Alex Goetz, DJ3BW/K6AGR*

ADJUSTMENT OF SEMIAUTOMATIC KEYS

AMATEURS who use bugs should be interested in learning how to adjust and maintain these keys. The required reading is included in the following instruction which the Bell System furnishes to employees and subscribers who use semiautomatic keys.

General

Semiautomatic sending keys (so-called because they make dots automatically) are commonly used at telegraph stations. Fig. 6-4 is a schematic diagram of one of these keys.

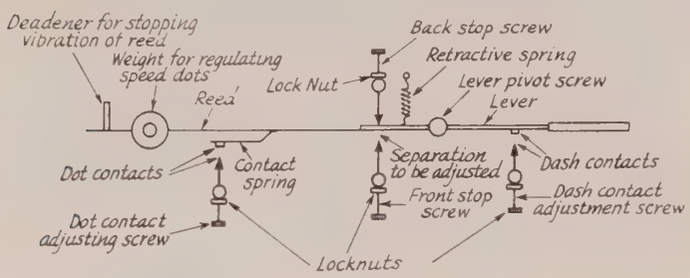


Fig. 6-4—Schematic diagram of the semiautomatic key referred to in the Bell System instructions.

The proper maintenance of these keys in accordance with the following instruction is necessary to insure good telegraph service.

Inspection

When signals are not satisfactory, examine the key for mechanical defects. See that contact points are clean and in alignment, with the faces parallel. The lever pivot screw should be loose enough to permit a free movement of the lever but not so loose as to make signals unsteady. All supporting parts should be rigidly fastened. See that cord and plug are in good condition.

Adjustment

After inspection has been completed, the key should be adjusted as follows:

1) Place the key on a level surface.

2) Adjust the back stop screw until the reed lightly touches the "deadener," and tighten the lock nut.

3) Adjust the front stop screw until the separation between the end of this screw and the lever is approximately .015 inches and tighten the lock nut. A greater separation is permissible if the operator prefers more lever movement.

4) Operate the lever to the right. Hold in this position and stop the vibration of the reed. Adjust dot contacts until they just "make" without flexing the contact spring and tighten the lock nut. As this is a very important adjustment it should be checked after setting up the lock nut to see that it has not changed.

5) In case the dots are either too light or too heavy, move the weight which is provided for regulating the speed (and which generally should be kept well toward the outer end of the reed) nearer the outer end.

Note A: After key has been adjusted as above, do not change adjustments to correct light or heavy signals except by moving weight toward outer end of reed.

Note B: Keys equipped with two weights should always have one weight near the outer end of the reed.

— Virgil E. Thompson, W1SEJ

A BUILT-ON CLICK FILTER FOR THE TYPE J-38 KEY

THE popular surplus J-38 key has a set of extra terminals which, when removed, provide space and mounting holes for a small "Minibox." The box may be used to enclose a key-click filter and also as the mounting for a send-receive switch. There is enough room on the rear wall of one of these boxes to accommodate a connector for the leads running to the receiver and the transmitter.

Nice thing about the setup is that the filter is placed right at the key where it belongs, and the send-receive switch is about as close to the key as it can be located.

— Clifford A. Mason, K2AFO

FULL RANGE SPEED CONTROL FOR SEMIAUTOMATIC KEYS

A HIGHLY successful method of controlling the speed of a bug or semiautomatic key is shown in Fig. 6-5. With this system, it is possible to slow down the dot frequency instantaneously to any desired rate.

The drawing is more or less self-explanatory. The only parts added to the original key are a hairpin-shaped piece of iron wire and one or more small cylindrical Alnico magnets such as those used in speaker manufacture. The hairpin is held in place under the thumbscrew which normally holds the sliding weight in position and the magnet or magnets hold themselves in the cradle formed by the hairpin.

The hairpin can be made from a section removed from an iron coat hanger. Before mounting the hairpin, move the regular weight up to

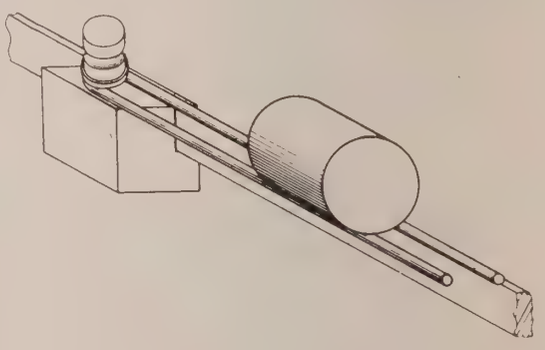


Fig. 6-5—Detail drawing of the speed-control for bugs or semiautomatic keys.

the maximum speed position. When the cradle is locked in position, orientate it with the open end facing toward the rear of the key. Thus, by merely removing the magnet or magnets, top speed is available without need for loosening any screws. To come down to a slower speed, put a magnet or two on the cradle (preferable sizes are those having a diameter measuring between ¾ and 1¼ inches) and slide same to the most effective position. Even with the heaviest combination of weights on my bug, and while keying at the rate of less than six dots per second, I can get over 50 cleanly formed dots before the bug comes to rest.

For a few weeks after this idea was first put to work, I had the extra magnets lying around on the desk where they were easily misplaced. When I finally remembered the basic properties of magnets, I simply placed them against the front panel of my receiver where they stay put until wanted.

— Cyrus T. Read, W9AA

TRANSMITTER KEYING WITH THE SURPLUS TG-34-A KEYER

THE type TG-34-A keyer is an automatic unit for providing code practice signals from an inked recording. The output of the keyer is an audio frequency note with sufficient power to supply a number of headsets. However, if the machine is to be used for keying a transmitter during code practice transmissions, testing, etc., it is necessary to convert the audio output signals into mechanical energy that will control a keying relay. Fig. 6-6 is a circuit that will make the necessary conversion.

The tapped secondary winding of the keyer output transformer (T_1) is coupled through a crystal diode to the base of a type 2N36 transistor. The transistor operates in a grounded-emitter circuit with the keying relay, K_1, serving as the output load.

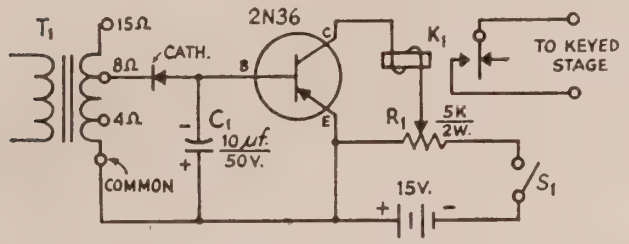


Fig. 6-6—Schematic diagram of the TG-34-A keying accessory used at W8DAP.
CR_1—Type 1N34A crystal diode.
K_1—D.p.s.t. sensitive relay (Advance AM/2C; formerly type K1504RF).
T_1—TG-34-A output transformer.

In operation, CR_1 conducts during negative half cycles of audio voltage, thus providing a negative base bias for the transistor. Although CR_1 rejects the positive audio voltage, it does charge C_1 while conducting. C_1, because of its high value of capacitance, *holds* the transistor base bias during positive-pulse periods of non-conduction with the result that a steady current flows in the base-emitter circuit whenever an audio signal of proper amplitude is applied to the diode. This, in turn, causes the collector current to *follow* the keyed input signal and properly energize the keying relay.

By using the 8-ohm speaker output taps and approximately one quarter "pot" of the bias and volume controls on the keyer, and with 10 to 12 volts applied to the transistor, perfect operation is obtained. The voltage divider, R_1, across the battery is used to find the proper transistor operating voltage and its setting depends on the amplitude of the controlled signal output of the keyer. Almost any type of battery may be used as the current drain is very small. A pair of Burgess type 4F5H 7½-volt batteries is used with the original circuit.

The relay listed is the only one of several tried that will follow the tape and still key the transmitter regardless of speed. This relay has two springs; one is a hinge type which connects the armature to the body, and the other is a "coil type" spring. Removal of the coil spring and adjustment of the hinge type until the relay *pulls in* at 3 ma. is necessary. Although K_1 is a d.p.s.t. affair, only one set of contacts is shown in Fig. 6-6.

With the exception of the batteries, all parts are mounted on a 1 × 3-inch "L" bracket attached to the keyer directly above the audio output terminals.

— Lee Dilno, W8DAP

"ANCHORING" THE J-38 KEY

THE popular and inexpensive surplus type J-38 key will normally walk, skid or tip during "brass pounding" unless it is secured to the operating table. Fastening the key to a fixed position to prevent movement is not always the most desirable remedy, especially so when you're new at the game and have not yet determined the best layout for the operating position.

One simple method of anchoring the key without permanently bolting it in position is to reverse the key on its rectangular bakelite mounting base. This places the knob *over* the mounting plate instead of allowing it to extend out and away from the base. Thus, pressure created by keying is exerted directly down onto the base instead of being applied to the end of a lever that extends out over the front end of the unit.

— Don Simon, KNØJCY

ONE-HAND KEY MONITONE SWITCH

USERS of Monitones (*QST*, Sept., 1948) know the inconvenience of not being able to zero beat received signals because of muting of the receiver by the Monitone.

The accompanying sketch illustrates how this trouble was eliminated by making use of a normally closed microswitch directly attached to the base of the bug or straight key. This switch is then connected in series with the r.f. or power supply of the Monitone.

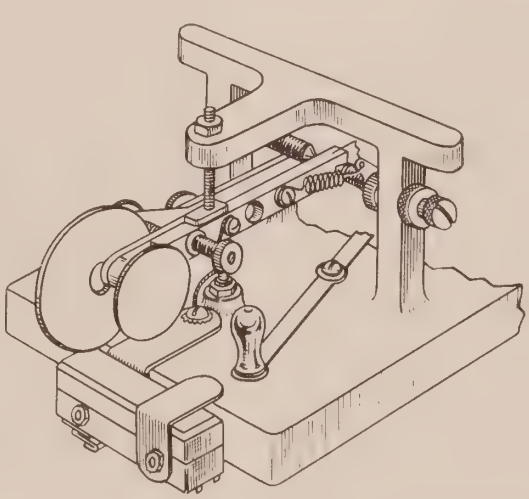


Fig. 6-7—Sketch showing the microswitch attachment to a standard "bug."

The transmitter can then be keyed and, with additional digital pressure on the actuator, the Monitone signal is cut off and the receiver operates normally. *— A. C. Coggan, VE3BOA*

MODIFYING THE HEATH VX-1 FOR C.W. BREAK-IN

AFTER obtaining a Heath VX-1 voice-controlled break-in unit, I looked about for a way to modify the unit for c.w. break-in. I studied the circuit, tried various methods, and finally arrived at the following changes.

The only additional components needed are an s.p.s.t. toggle switch and a 0.1-μf. capacitor. Remove the ground end of the 100,000-ohm grid resistor on Pin 7 of the 12AX7 speech amplifier tube and connect it to one side of the toggle switch. Ground the other side of the switch as

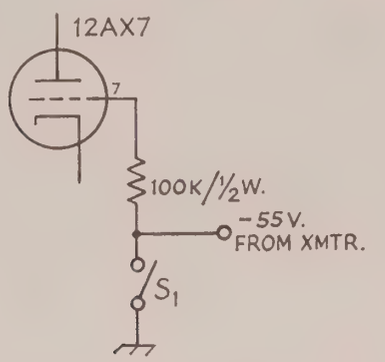


Fig. 6-8—Insertion of switch S_1 allows the VX-1 to be used for c.w. break-in.

shown in Fig. 6–8. Now connect the 0.1-μf. capacitor in parallel with 0.1-μf. capacitor that is already connected to the 7.5-megohm time-

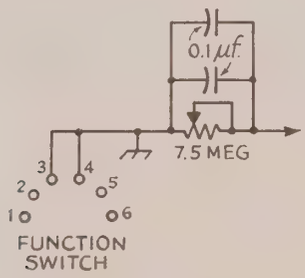


Fig. 6-9—Diagram showing the additional 0.1-μf. capacitor connected across the 7.5 megohm time-delay control.

delay control. See Fig. 6–9. Consult pictorial diagram No. 4 on page 16 of the instruction manual for aid in finding the above components.

If more time delay is wanted, add more capacity in parallel with the capacitor across the 7.5-megohm time-delay control.

The above change will work on a transmitter using grid-block keying or on one that makes use of a blocking bias for keying. The bias can be obtained from a battery that is keyed by a relay. My transmitter uses −55 volts bias to key the oscillator. With the toggle switch open and the function switch on vox, it is ready for c.w. break-in. With a little practice, the most pleasant setting can be found. When keying begins, the relay in the VOX will close and stay closed until keying is discontinued, then the relay will open after a short delay.

The unit's function can easily be switched to phone operation, of course, by throwing the toggle switch to the other position.

— Paul G. Marsha, K4AVU

USING THE SELECT-O-JECT AS A KEYING MONITOR

ANYONE who owns and operates one of the National Select-O-Jects may be interested in how the unit is used as a keying monitor here at WNØRVF. The stunt has worked out so well that

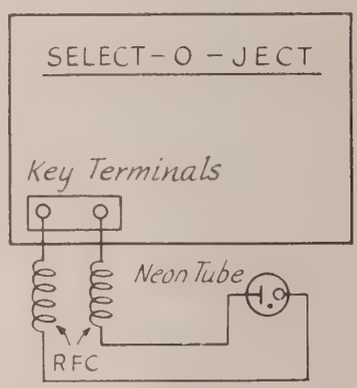


Fig. 6-10—Arrangement employed by WNØRVF to permit using a Select-O-Ject as a keying monitor.

earlier plans to build a more complex monitor have been given up. The system employs a Select-O-Ject keyed by a small neon tube as shown in Fig. 6-10. The r.f. voltage that is used to ignite the bulb is obtained by placing the tube in the r.f. field of the transmitter output amplifier. Lead length between the bulb and the S-O-J is not critical and unshielded wire has been used to date. However, r.f. chokes should be connected in series with the leads and should be placed as close as possible to the key terminals of the S-O-J. The frequency of the tone fed to the phones when the transmitter is keyed may be varied by means of the Select-O-Ject frequency control. My own experience with the monitor is that it follows keying without lag and reacts to bug keying much more favorably than some of the systems which employ relays to obtain the same effect.

— Tom Bakersmith, WNØRVF

7. Hints and Kinks . . .

for V.H.F. Gear

USING THE BC-459 WITH THE V.H.F. OVERTONE OSCILLATOR

ALTHOUGH using the BC-459 (7 to 9 Mc.) as the v.f.o. for a 50-Mc. transmitter may be old stuff to many v.h.f. men, it is possible that some newcomers to the World Above 50 Mc. may not realize how easy it is to couple one of these Command transmitters to the ever-popular overtone crystal oscillator.

Fig. 7-1 shows the method of coupling a BC-459 to the grid of a triode overtone oscillator. The oscillator portion of the circuit (components to the right of the dashed line) is identical to that used in simple transmitters described in the V.H.F. Transmitters chapter of recent editions of the *Handbook*. To the left of the dashed line, we see the coaxial line from the v.f.o., a 220-$\mu\mu$f. coupling capacitor and the connections to the transmitter crystal socket. All connections at the transmitter end of the coaxial line should be as short as possible.

One interesting feature of the arrangement is that the overtone circuit takes on an entirely new look merely by replacing the crystal with the v.f.o. connections. The instant that the crystal is removed and a ground connection provided at the crystal socket, the circuit becomes that of a frequency multiplier. In this case the stage becomes a frequency tripler using 8-Mc. excitation for 25-Mc. output. Incidentally, the stages that follow the 12AT7 oscillator are also of *Handbook* design.

The required v.f.o. range for covering the entire 50-Mc. band is 8.222 to 9 Mc. Stable output throughout this range is obtained here at W9DRY by operating with only 105 volts applied to the oscillator and both the plates and screens of the amplifier tubes of a BC-459. The Heathkit v.f.o. also works well with the arrangement after the 7-Mc. range has been pulled up into the 8-Mc. region, but does not offer the advantage of oscillator-frequency calibration.

— *Ray L. Sherwood, W9DRY*

THE JOHNSON RANGER AS A 50-MC. EXCITER

OWNERS of the Johnson Ranger transmitter may obtain 25-Mc. output for driving a 50-Mc. doubler in the following way:

Using the v.f.o., tune up the transmitter in the normal way with the band switch in the 11-meter position and the v.f.o. at the low edge of the band. Now switch to an 8-Mc. crystal and retune the buffer and final for resonance points nearer maximum capacitance (toward the 0 end of the dials). With the usual surplus type crystals, it is possible to develop nearly maximum grid drive. Keying ranges from fair to very good, depending on the crystal. The audio output of the Ranger is available at the accessory socket for use in such an application.

The rabid 50-Mc. man may decide to pad the 11-meter position of the v.f.o. to obtain v.f.o. control at the above frequencies. I have not tried this and therefore cannot vouch for the idea.

— *Otto Woolley, WØSGG*

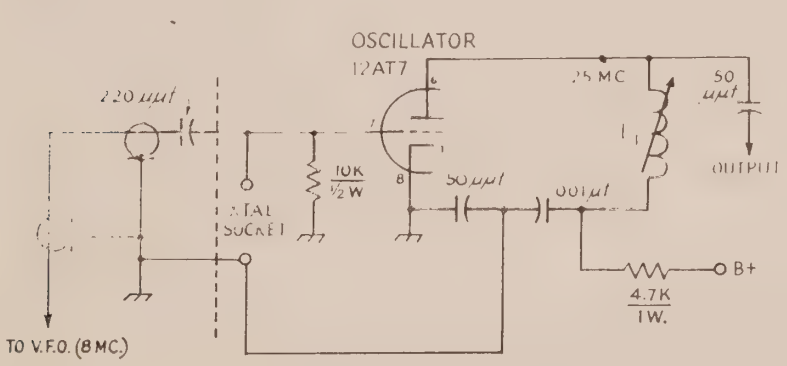


Fig. 7-1 — Circuit diagram of a v.h.f. overtone oscillator driven by a Command transmitter. W9DRY uses a BC-459 (7 to 9 Mc.) as the v.f.o. and drives a 50-Mc. frequency multiplier with 25-Mc. excitation obtained from the 12AT7. L_1 is 24 turns No. 30 enam. close-wound on a ⅜-inch slug-tuned form (National XR-91).

NOTES ON THE GONSET COMMUNICATOR III

One possible characteristic of the Gonset Communicator III is hum modulation of the transmitted signal. This occurs only during push-to-talk operation when microphones similar to the surplus T-17 are in use. Under these conditions, modulation by a.c. hum or vibrator whine can be quite severe. A glance at the microphone circuit will show that the relay circuit and microphone "talking" circuit have a common return wire in the microphone cable. Therefore, these circuits are coupled across the resistance of a common wire, namely the resistance of a five- or six-foot length of wire. This condition can be alleviated if a four-wire microphone cable is substituted for the original three-wire cable. This eliminates the common return lead and reduces hum modulation to negligible proportions. Self-coiling four-wire cords which are ideal for this purpose are sold as replacement cords for some types of dynamic microphones. One possible trouble which will remain after this modification is the contact resistance between the sleeve of the PL-68 and the jack. Be sure that the PL-68 is clean and bright, and that it is not worn to a sloppy fit.

— R. A. Johnson, K2EOC

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Some owners of the popular Gonset Communicator III have run into difficulty with the push-to-talk arrangement. Carbon mikes which do not have a conventional push-to-talk circuit, or do not open the mike circuit when the button is released, have been found to cause feedback. In addition, when a conventional push-to-talk mike is used, hum is often evident. This hum disappears when the front-panel "transmit-receive" switch is used instead of the push-to-talk button. The hum is caused by the a.c. component of the voltage drop in the mike control wire appearing on the grid of the speech amplifier. Both of the above difficulties may be remedied by making the following modifications.

First, locate the 1.5-megohm resistor connected at pin 2 of the 12AX7. This is R_{31} in the 6-meter or R_{32} in the 2-meter model. Lift the other end of this resistor from ground. At this end, connect a 0.1-μf., 200-volt capacitor and a 470,000-ohm resistor. The free end of the capacitor is then grounded to a convenient spot, such as pin A of the heater terminal strip. The free end of the 470,000-ohm resistor is then connected to the tip prong of the mike jack which already has a .01-μf. ceramic and a 68,000-ohm resistor connected to it.

If your transmitter is stamped with "M-1" or higher on the rear chassis lip, the above modification has already been made at the factory.

— Samual M. Bases, K2IUV
— Rudolph Schwerdt, jr., K2QVU

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To copy c.w. with a Communicator III simply plug in a crystal having a frequency at the i.f. of the Communicator. The function switch is thrown to "spot" for weak signals. For stronger signals requiring greater injection, the switch is thrown to "exciter." In this way, a crystal controlled b.f.o. is furnished. A 2.3-Mc. crystal is used for the 6-meter Communicator and a 6-Mc. crystal for the 2-meter model.

— Irvin L. Schroeder, W9VCL

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The accessory v.f.o. for the Communicator III can be employed as a b.f.o. for both the 6- and 2-meter Communicators by throwing the v.f.o. switch to "spot" and beating the c.w. signal with the v.f.o.

— Woodrow Smith, W6BCX

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While trying out a factory-fresh Gonset Communicator III, I was intrigued by how I could arrange my surplus 243 crystals in the six-position socket. The spacing is too close to accommodate more than three crystal holders. Two adjacent crystal positions will accept FT-243 crystal holders back to back.

Examining my 243 crystals I found that they all have about the same outside dimensions, but that some cases are shallow with thick plastic covers and some are deep with thin metal covers. Using parts from a handful of junk crystals, I assembled my crystals in "thin" FT-243 holders made up of a shallow case with a thin cover. The modified cases measured about $\frac{3}{8}$-inch thick and racked up neatly in the crystal sockets.

Before starting this project, be sure to clear your working space since crystals may look just alike when out of their holders. Clean the rubber gasket off the metal cover, then insulate the center, at the point of spring bearing, with a bit of plastic electrician's tape. Use the YL's tweezers to handle the crystals and pressure plates. The three screws will be too long, so cut them down with a file using a nut as a thread guard. Seal the modified crystal cases with a plastic spray after assembling and checking. Be sure to mark the cases with the correct crystal frequency if the covers have been changed.

— Phares W. Calliham, W4ZIO

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Late productions of all models of the Gonset Communicator III incorporate the following circuit modification. The purpose of this change

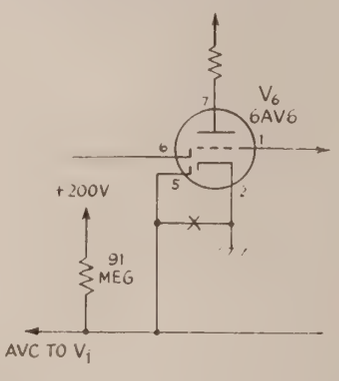


Fig. 7-2—Diagram showing modification to Communicator III a.v.c. circuit.

is to delay the application of a.v.c. voltage to the cascode r.f. amplifier, thereby improving signal to noise ratio on medium strength signals. (Receivers having "a.v.c." stamped on the rear apron of the receiver chassis have been wired with this change at the factory).

First remove the jumper connected between pins 2 and 5 of the 6AV6 socket (X in Fig. 7-2). Also remove the lead between pin 5 and the ground lug. Disconnect the .01-μf. capacitor lead from pin 5 and connect to the ground lug. This frees all connections from pin 5. Next, locate the three lug terminal strip mounted between the v.h.f. oscillator coil and i.f. transformer no 5, see Fig. 7-3. Connect a 3-inch length of No. 20 solid insulated wire between pin 5 of the 6AV6 socket and the forward lug of the terminal strip. Then connect a 91-megohm, ½-watt resistor between the forward and aft lugs of the terminal strip. Now replace the 3rd r.f. amplifier tube (V_5) with a 6BJ6 tube.

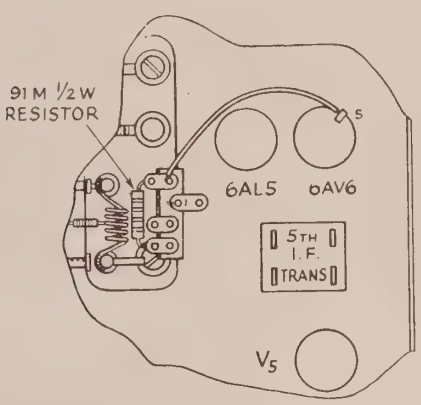


Fig. 7-3—Sketch showing placement of the 91-megohm resistor and the new lead to the 6AV6.

The above modification is very desirable, but obtaining a 91-megohm resistor may be a problem. However, it is a standard Motorola replacement part on certain late model Motorola auto radios and probably can be found in service shops which specialize in repair of Motorola sets.

— *Woodrow Smith, W6BCX*

LOW-FREQUENCY CRYSTALS FOR THE 6-METER GONSET III

While the manufacturer recommends the use of 8-Mc. crystals in the 6-meter Gonset Communicator III, I have found that 6-, 5-, 4-, and 3-Mc. crystals, having harmonics between 50 and 54 Mc., can be used successfully. An approximate check on harmonic frequency can be made by using the Communicator receiver with the meter switch in "Spot" position.

Grid drive may be low while using these crystals, so tune-up is a little more critical than with 8-Mc. crystals. Output may be down 20 or 30 per cent but signal reports from local contacts should not suffer. Performance of individual transmitters varies, therefore it would be well to have a friend check on his receiver to verify that unwanted harmonics are not present.

— *Phares W. Calliham, W4ZIO*

ANTENNA HINT FOR THE GONSET COMMUNICATOR

Horizontal polarization of a Gonset portable antenna can be most easily obtained by mounting the whip in an Amphenol type 83-1AP right-angle connector. When this assembly is mated with the Gonset antenna receptacle, it will cause the whip to extend out in a horizontal plane without need for tipping the Communicator on its side. If the 83-1AP is not too tightly coupled (mechanically) to the antenna connector it will allow the whip to be swiveled about in *beam* fashion, thus introducing some choice of directivity to the system.

— *Lester Reiss, W2BR*

PUSH-TO-TALK FOR THE COMMUNICATOR I AND II

Mobile operation using the Communicator I and II can be made much safer and more convenient by adding a push-to-talk circuit. All that is required is a solenoid, a spring, and a couple of screws. Drill holes in the send-receive knob and in the bottom of the Communicator cabinet. Connect the spring (an old dial spring will do) to the send-receive knob and to the screw that holds the tuning eye shield to the cabinet. (see Fig. 7-4). Mount the solenoid (which can be obtained from an old pinball machine) on a bracket and screw it to the bottom of the cabinet. The solenoid can be keyed by the push-to-talk switch in the microphone.

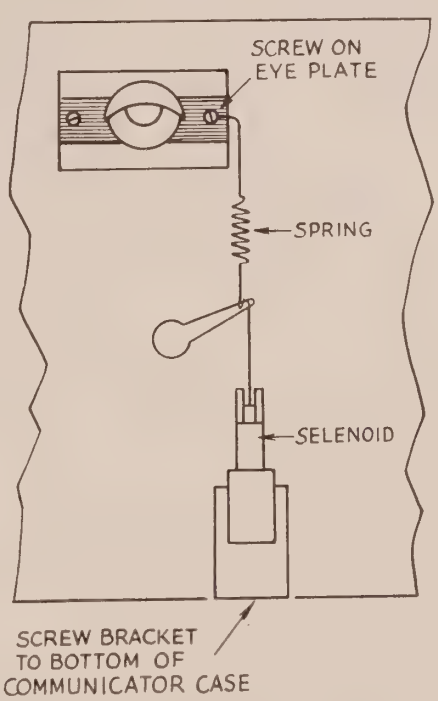


Fig. 7-4—Sketch showing details of Communicator I and II push-to-talk feature.

When you decide that it's time to trade in the Communicator, remove the spring and solenoid and all you have is a scarcely visible screw hole in the cabinet bottom.

— *E. V. Blaize, jr., W5TVW*

A "TEE" TRAP FOR V.H.F.

THE construction illustrated in Fig. 7-5 provides a means of connecting a series-tuned v.h.f. trap across a coaxial cable without actually cutting into the line. The idea was developed for use with a 144-Mc. converter that was picking up Channel 7 TV transmissions along with the 144-Mc. signals, but it may be used to free coaxial lines of other types of interference.

The connector used in the assembly may be either a type 83-1T or a 31-008 (BNC), both made by Amphenol. If the former is used, a good joint between coil and connector can be made with a ½-inch No. 8 brass machine screw. A piece of solid copper wire may be used for the same purpose when the connector is a type BNC. If

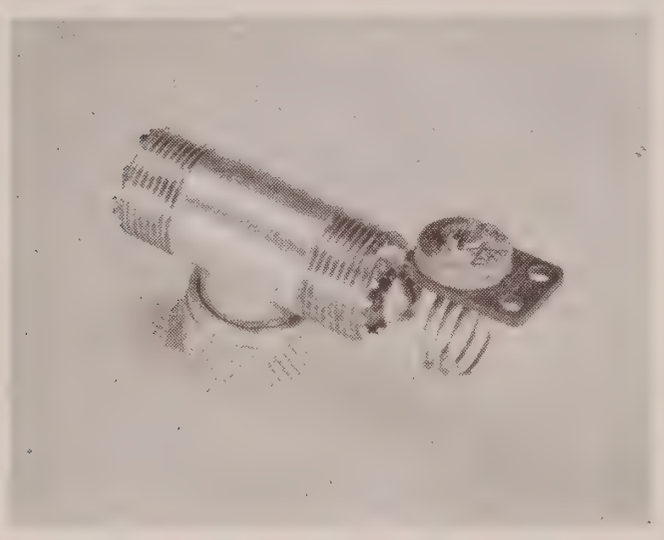


Fig. 7-5—W8TPL's series-tuned "Tee" trap. C and L, discussed in the text, form a series-resonant circuit at the frequency of an interfering signal. Capacitor illustrated is a Centralab type 827-C, 6- to 30-$\mu\mu$f. trimmer.

possible, solder the rotor arm of the padder to the outside of the connector so it will be grounded when the unit is installed in the line. Naturally, tuning adjustments can be made with less difficulty if the rotor is grounded.

Values of C and L that will series resonate at the interfering frequency can be determined quite easily with the aid of a grid-dip meter. If a grid-dipper is not available, the coil size may be varied — by the cut-and-try method — and the capacitor adjusted until the interference is suppressed or eliminated

There is no reason why a trap of this type cannot be used to suppress a v.h.f. harmonic generated by a low-power transmitter. However, it may be necessary to rig a shield around the tuned circuit.

— Robert V. Nedimyer, W3LJQ

THE HEATHKIT GRID-DIP OSCILLATOR AS A 144-MC. TRANSMITTER

IF YOU are interested in having a lot of fun with flea power and f.m. at 144 Mc., try getting out with a Heathkit Model GD-1B grid-dip meter. Plug a crystal mike into the phone jack of the unit, couple an antenna to the tuned circuit — and you are ready to go.

After the initial thrill of playing around with flea power, I constructed a 4-element 2-meter beam for use with the dipper. With this antenna in use, I have enjoyed some very fine contacts with K2EHI. In fact, I'm having so much fun with the g.d.o. transmitter that my low-frequency gear is starting to gather dust!

— A. J. Castellano, jr., W1ZMB

THE VIKING RANGER ON 50 MC.

SINCE the 11-meter band is no longer available, the 11-meter section of the Viking Ranger transmitter can be put to use on 6 meters. The Ranger v.f.o. tunes 6550 to 6865 kc. on 11 meters, giving a final output of 26.2 to 27.45 Mc. In order to use the v.f.o. for 6 meters it will be necessary to move the v.f.o. frequency down to 6250 kc. To do this, the small variable 15-$\mu\mu$f. padder C_4 (marked 11M on top of the v.f.o. compartment) is rotated near maximum capacity until it hits 6250 kc. This frequency can be checked by listening on a communications receiver at the proper frequency. The following stages of the transmitter are tuned so that the final output will be on 25 Mc. There is plenty of 25-Mc. output power available to drive an external doubler and amplifier.

For those who would like to have 6-meter output direct from the Ranger, a little more work is involved. The inductance in the grid circuit of the 6146 is too high to hit 6 meters without changing the entire switching circuit. The easiest method is to double to 50 Mc. in the plate circuit of the 6146.

There are two sets of jumpers on the 10- and 11-meter positions of switch SW_{3B} (front and rear sections). These jumpers should be unsoldered from the front and rear sections of SW_{3B}. This gives a spare contact on SW_{3B} rear which can be connected to a tap on L_{11A} for 6 meters. Fasten on a piece of No. 14 solid wire to the turn closest to the plate end of the coil near C_{37} (.002-$\mu\mu$f. capacitor). Very carefully feed this lead through the same hole that the 10-meter lead passes through and connect it to the vacant contact on SW_{3B}. Be sure to space both wires evenly and don't allow them to touch each other or come too close to the chassis.

Put the band switch in the 11-meter position and tune up just as you would for the other bands.

— L. A. Gerbert, W8NOH

NOTES ON THE GONSET V.H.F. V.F.O.

IN order to minimize spurious emissions, the Gonset V.F.O. for 6 and 2 meters has an output of 24 to 27 Mc. In spite of the fact that this is mentioned in the instruction manual, some hams seem to think that the v.f.o. is operating in the 8-Mc. range. This is not the case. When the v.f.o. is used with equipment other than the Communicator, it may be necessary to modify the crystal oscillator circuitry if the oscillator was designed for 8-Mc. crystals. The Communicator III crystal oscillator is designed to work either with an 8-Mc. crystal or from the 24-27 Mc. output of the v.f.o.

— Woodrow Smith, W6BCX

SIMPLE V.H.F. R.F. OUTPUT INDICATOR

AN inexpensive trimmer capacitor and an ordinary pilot lamp, wired in series as shown in Fig. 7-6, makes a useful output indicator for v.h.f. transmitters. An indicator of this type is especially helpful at v.h.f. where one of the most common indications of circuit resonance — minimum plate current — is frequently difficult to observe.

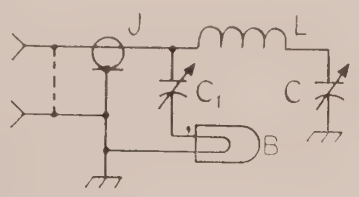


Fig. 7-6—Circuit of the simple v.h.f. output indicator. C, L and J are transmitter components; B and C_1 are indicator components.

The indicator may be permanently connected across the series-tuned output circuit of a transmitter. A 3–30-$\mu\mu$f. trimmer and a 60-ma. bulb are used with the 30-watt rig here at W2FFY. The power consumed by the lamp, about a tenth of a watt, is negligible. By adjusting the trimmer and by employing lamps of various current ratings, the indicator circuit can be used with a wide range of power levels.

In addition to providing means for indicating maximum power output, the arrangement provides a continuous check on transmitter performance. The fact that the indicator is permanently connected across the output circuit prevents the need for retuning as is frequently the case when plug-in or clip-on indicators are temporarily installed.

— *George E. Hyde, W2FFY*

144-MC. TVI TIP

INTERFERENCE caused by rectification in the first audio stage of either a broadcast or a TV receiver can usually be eliminated by adding a 250-$\mu\mu$f. bypass capacitor between grid and chassis, and by lowering the value of the grid-leak resistance to something less than 3 megohms (see BCI and TVI Chapter of *The Radio Amateur's Handbook*). The most difficult phase in testing to determine the effectiveness of this preventive measure is the pulling of the chassis — particularly if the set is not one's own.

A simple method of making the initial test or making a permanent installation without "pulling" the chassis is to use a CBS-Hytron test adapter that has been equipped with the bypass capacitor and a shunt resistor. Merely remove the audio tube, insert it in the adapter, and then plug the whole business back into the audio tube socket. Types SH-27 and SH-29 adapters are available for the 7- and 9-pin miniature tubes, respectively, and Type SH-28 accommodates the 8-pin octals.

This method of demonstrating how certain types of TVI can be remedied without appreciable bother or fuss is bound to impress the complainant and, in all probability, will result in a better understanding of where the trouble really lies.

— *Jack Livingston, K2POO*

V.H.F. CRYSTAL OSCILLATOR

SHOWN below is a circuit that gives 2-meter output directly from 8-Mc. crystals. The circuit is actually two oscillators in one; L_1C_1 forms a tank for a conventional ultraudion 144-Mc. oscillator, and the tuned circuit L_3C_2 in conjunction with the crystal forms a tuned-plate crystal oscillator. The purpose of L_2 is to add some third harmonic voltage to the grid, thereby giving a more optimum wave form. With the circuit adjusted properly, the 144-Mc. oscillations are synchronized or "locked in" with the 8-Mc. oscillator, and hence give 144-Mc. crystal controlled output.

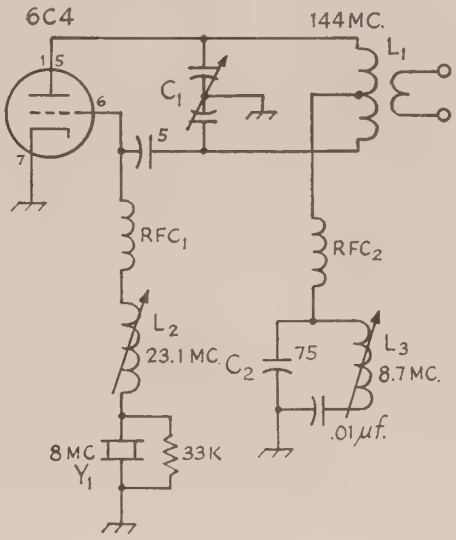


Fig. 7-7—V.h.f. crystal-controlled oscillator. Unless otherwise indicated, capacitances are in $\mu\mu$f., resistances are in ohms, resistors are ½ watt.

C_1—5-$\mu\mu$f.-per-section butterfly capacitor (Johnson 5MB11).
L_1—5 turns No. 19, ⅜-inch diam., ⅜ long, center tapped with 2-turn link.
L_2—17 turns No. 26 enam., ½-inch diam., slug-tuned form.
L_3—12 turns No. 26 enam., ½-inch diam., slug-tuned form.
RFC_1, RFC_2—30 turns No. 26, 3/16-inch diam., ¾ inch long.

The circuit is not much harder to adjust than an overtone crystal oscillator. First grid-dip L_1C_1 to 144 Mc., L_2 to 23.1 Mc., and L_3C_2 to 8.7 Mc. These frequencies are about right for an 8-Mc. crystal; if some other crystal is used, they must, of course, be changed proportionately. Next, apply plate voltage and tune in the 18th harmonic of the 8-Mc. crystal on a two-meter receiver. Tune C_1 for maximum S-meter reading (being careful to avoid receiver overloading). It should be possible to find settings of L_2 and L_3 that will permit a very sharp but smooth peak in the tuning of C_1 without plops or heterodynes on either side of resonance. This will not coincide with the settings of L_2 and L_3 that give maximum output. The output is insufficient to drive a Class C amplifier directly but is adequate for local oscillator use.

— *Frederick W. Brown, W6HPH*

IMPROVED V.H.F. COIL FOR GRID-DIP METERS

V.H.F. MEN who use any of the popular makes of grid-dip meters know that they all leave something to be desired when it comes to convenience above about 50 Mc. The coil for the highest range is a stubby loop of such dimensions that it is difficult if not impossible to couple it closely to many of the circuits one wants to check. In addition, at least one manufacturer divides his scales in such a manner that the 144-Mc. band comes close to the ends of the ranges on the last two coils. This makes for frequent coil changes when working in the vicinity of that band.

One method of working in cramped quarters with the coils that come with the instrument is to use a short transmission line, with loops at each end. This link-coupling is likely to be awkward. It also may be confusing, due to resonances in the line.

The plug-in inductor shown in Fig. 7-8 takes into account the fact that a given length of wire formed into a circle or semicircle has a lower resonant frequency than the same length made into a hairpin loop. As the sides of the hairpin are brought closer together the resonant frequency for a given setting of the tuning capacitor goes higher. It is thus possible to make a loop of considerable length that will tune the same frequency range as the stubby loop that is part of the original coil complement of the grid-dip meter. A loop 3 inches long will enable you to couple to many converter and transmitter circuits that cannot be reached with the tiny loop that came with the meter.

The copper wire used in the loops shown in Fig. 7-8 has a rectangular cross section 0.31 by 0.19 inches. Rectangular wire or rod makes a neater looking inductor than round wire, and it is easier to drill, but the same idea may be used with round stock. Inductance for the same loop

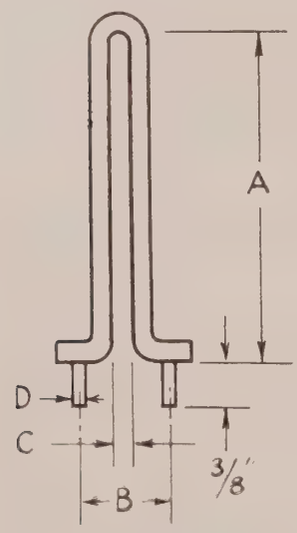


Fig. 7-8 — Dimensions of modified v.h.f. inductor for Heathkit and Millen grid-dip meters. See table.

spacing will be higher for round wire of the same area of cross section. The table gives dimensions of several inductors made for use with Millen and Heathkit grid-dip meters.

It will be seen that Coil 2 duplicates the highest range of the Millen meter, but it is more than 2½ inches long, as compared with the Millen coil that is only about a half inch in length. Coils 3 and 4 give a more useful frequency spread for the amateur who is frequently called upon to work around both 144 and 220 Mc. They hit both amateur bands, with convenient leeway on either side of each band.

To make the loops it is well to start with a piece of wire about 10 inches long, for ease in handling. Secure the wire in a vise, with 5 inches extending. Bend the wire 90 degrees, using a block of wood as a cushion for the hammer. Using a spacer of a thickness determined from the table, bend the other side down and squeeze the sides together in the vise. Bend the ends at right angles, using the hammer and wood block.Drill the legs for proper pin spacing, insert pins and solder them in place. Trim the legs to a suitable length for the instrument.

The finished inductor may be sprayed with clear lacquer, to prevent shorts when using the meter near live circuits. The insulating quality of the lacquer coat should be tested at frequent intervals. It goes without saying that the meter should never be brought close to circuits carrying dangerously high voltages.

The new tuned circuit must now be calibrated. This can be done in several ways. Perhaps the simplest is to borrow another grid-dip meter that tunes the same frequency range. The oscillator may also be monitored in a receiver that tunes the desired range, if one is available. Lacking either of these facilities, calibration at a few points can be made with Lecher wires. As the calibration requirements for grid-dip meters are not critical, any of these methods should give satisfactory accuracy.

Dimensions and frequency ranges for Heathkit and Millen grid-dip meters are given below:

Coil	*Freq. Range*	*A*	*B*	*C*	*D*
1 (Heathkit)	85–240 Mc.	2.69″	0.75″	0.125″	0.116″
2 (Millen)	125–300 Mc.	2.69″	1.25″	0.05″	0.125″
3 (Millen)	120–270 Mc.	2.5″	1.25″	0.125″	0.125″
4 (Millen)	110–260 Mc.	3″	1.25″	0.125″	0.125″

— A. J. Newland, W2IHW

A NOISE GENERATOR HINT

HERE'S a noise generator hint that came from W9EHX. It uses a 2-volt 60-ma. pilot lamp instead of a crystal diode, but is otherwise

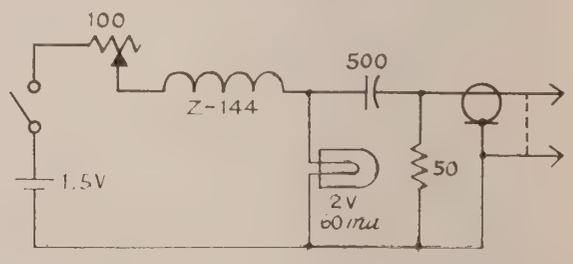


Fig. 7-9 — Noise generator using 2-volt 60-ma. pilot lamp, in place of the usual crystal diode.

similar to the diode job described in *QST* for July, 1953. The r.f. choke didn't appearnecessary but is advisable to prevent loss of noise through battery circuit. Output is constant, in comparison to the rather variable results obtained

with some crystal diodes. I built mine in an old soup can from junk parts, which kept the cost close to nothing. The load resistance should be equal to the impedance of line used to feed antenna. It shows about 4.5 db. of noise with my best 144-Mc. converter. More noise could be obtained with increased filament voltage, at expense of shorter lamp life. Other types of lamps deliver about the same noise output, so a 60-ma. type is most economical. The coax fitting should match that on converters to be checked. Make all leads as short as possible.

— W. E. Rose, jr., W9KLR

TWO-METER TVI HINTS

THERE'S always something new on the TVI front. You think you know all the answers — and then along comes a new model with some special TVI features built in. Such is one of the 1956 RCA receivers. It has a top-tuning setup that requires long leads to the volume control — and, of course, they would turn out to be almost exactly a quarter-wavelength long at 134 Mc.!

W1VSE, New Britain, Conn., ran into a hornet's nest with several of these receivers, the trouble being audio rectification. No picture interference, but W1VSE and any other 2-meter station within a half mile or so came in S9 on all channels. The manufacturer shielded the volume control leads, but the length being what it is the shielding is ineffective at 144 Mc. The solution was twofold.

First, the bracket on which the tuner and volume control are mounted should be bonded to the chassis with a strip of copper or aluminum about one inch wide. Then the shielded volume control leads should be tied together to the strap in at least three places.

Another suggestion that works with all forms of 2-meter TVI where the interfering signal comes in on the TV antenna: Insert traps in each side of the 300-ohm antenna lead. These may have to go right at the point where the lead enters the tuner, if the field around the TV set itself is strong. The traps are made of three turns of No. 18 wire, about ¼ inch diameter, tuned with a 3–30 $\mu\mu$f. trimmer. These can be tuned up at home by putting them on your own TV set and resonating the traps with a grip-dip meter.

No grid-dip meter? No TV set? You can still do it. Put them in the antenna lead to your 2-meter receiver and null out a strong signal near your regular frequency. If your converter uses coaxial input, use a balun to provide a balanced line in which to insert the traps for adjustment purposes.

PUTTING THE DX-35 ON 50 MC.

HERE is a simple step-by-step routine for putting the DX-35 on 6, sent in by K2VIN. Changes are made by cutting out the 10-meter band, but replacement of it at a later date should not be difficult. The 10-meter coil has 4 turns; cut it down to 2. Make a new grid coil for the 6146, using 9 turns ¼-inch diameter, same length as the original. Bypass the low end of the 6146 grid resistor. Tune the oscillator plate circuit to twice the frequency of the crystal, which should be in the 8.4-Mc. range.

The second 12BY7 triples to 50 Mc., driving the 6146 straight through. Tuning is similar to that on lower bands, but the operator should be sure that he has the right harmonic at each tuned circuit.

REDUCING SPURIOUS RESPONSES IN 220-MC. CONVERTERS

RECEPTION on 220 Mc. is complicated, in many areas, by the presence of strong TV signals on the high bands. If you have a TV station on Channels 7 to 13 within line of sight, you're likely to hear it (and maybe little else) on 220 Mc. Various means of improving front-end selectivity and eliminating unwanted responses can be used in such cases, but perhaps the simplest is the series trap.

W4UMF, Arlington, Va., had such a bad time from Channel 11 that he used to wait until after the station went off the air to do any listening for 220-Mc. DX. With a 10-Mc. i.f. and a broad-band front end, there was practically nothing to stop the TV signal image from showing up every 15 kc. across the lower portion of the 220-Mc. band. To rectify this state of affairs, Tom made up the simple series trap shown in Fig. 7-10. With it connected directly at the antenna input of the converter, and tuned to Channel 11, practically all the TV buzzes disappeared.

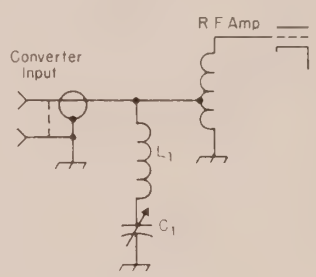


Fig. 7-10—Series trap used by W4UMF to reduce image from Channel 11 in his 220-Mc. converter. Constants given below are for Channel 11. For other frequencies the coil, L_1, should be made as high inductance as possible, with C_1 tuning near minimum.

C_1—1.5-5$\mu\mu$f. miniature variable.

L_1—6 turns No. 12, ⅜-inch diam., close-wound.

At least two dividends came from this simple operation. Expecting to take some signal loss with the trap, W4UMF was surprised to find signals on 220 better than they were before the trap was installed! A quick check showed that the TV signal had been biasing off the mixer, reducing the response of the converter on all signals. Still better, at least a third of the TV oscillator birdies formerly encountered have now disappeared. Apparently, quite a few had been heterodyned in by the Channel 11 energy.

Constants given are for Channel 11, but the same method will work for other frequencies. The trap should be as high L and as low C as possible. Preferably, it should be shielded from the converter circuitry, to prevent unwanted coupling.

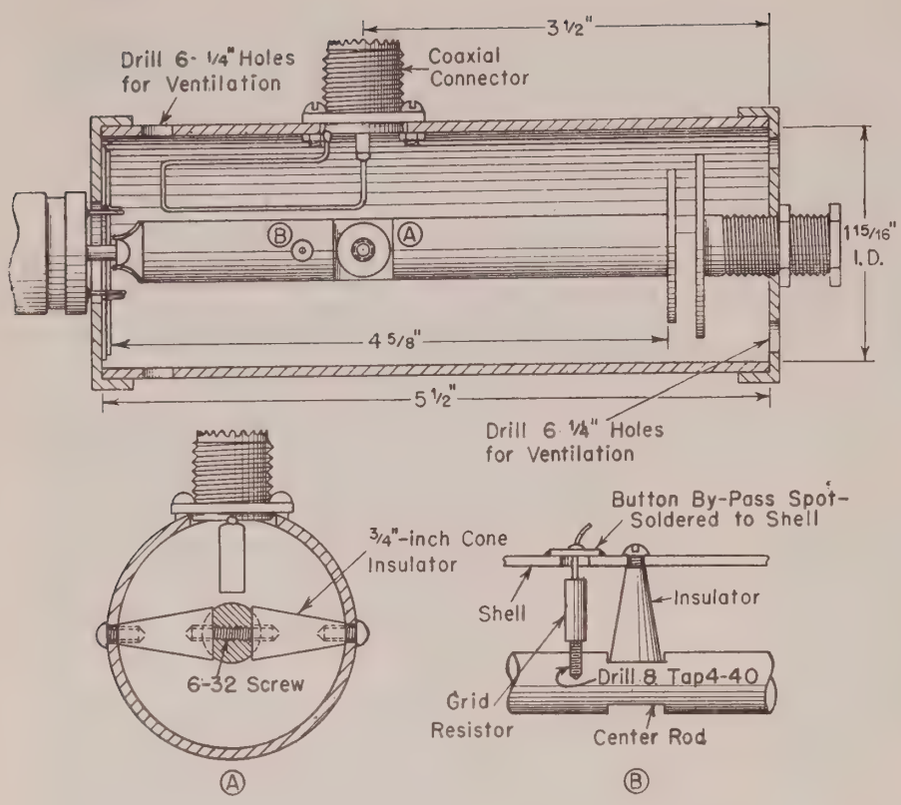


Fig. 7-11—Details of the coaxial-line grid circuit for a 4X-150A amplifier used on 420 Mc. by W1QVF. Modifications of the surplus gold-plated tank are given in the text.

COAXIAL GRID CIRCUIT FOR 4X-150A AMPLIFIER

A SQUIB in April, 1953, *QST* mentioned that we were running a 4X-150A amplifier straight-through on 432 Mc. This resulted in a batch of letters asking, "What do you use for a grid circuit?" Fig. 7-11 gives the details (the plate circuit of our amplifier follows the design by W1PRZ in May, 1951, *QST*). The grid circuit is made from the coaxial tank from a war-surplus item known as the "gold-plated special" test oscillator.

Modification of the tank for our grid circuit application is done in this fashion: (1) Cut it down to 5½ inches. (2) Turn down the disk on the inner conductor to 1¼ inches diameter. (3) Drill ventilation holes, as indicated in Fig. 7-11, in the end plate and at intervals around the outer conductor near the grid end. (4) Mount the output coupling loop and coaxial connector. (5) Mount the inner conductor on stand-off insulators (see Detail A). The inner conductor must be filed flat, or hammered slightly out of shape, to make room for the ¾-inch cone stand-offs. (6) Mount the grid resistor and its feed-through bypass. The inner end of the resistor is soldered to a 4-40 screw, and the inner conductor is tapped so that this can be screwed into it (see Detail B).

Where the amplifier is to be grid-modulated with a TV signal, the grid resistor is replaced with an r.f. choke consisting of about 12 turns of No. 22 wire on a 1-watt resistor. The output coupling loop is made of copper or brass strip, ¼ inch wide and 4 inches over-all length. This is soldered to the connector and adjusted to suitable shape before mounting the connector in place.

— *Tom McMullen, W1QVF*

USING THE T-23/ARC-5 ON 220 MC.

HUNDREDS of ARC-5 rigs are in use on 144 Mc., a frequency where they work without modification. It's not much of an operation to convert one of the channels to 220 Mc. Here's how:

Convert Channel D to 220 Mc. The oscillator plate coil is changed to 11 turns No. 24 enamel, 5/16 inch long. The 1625 tripler plate winding requires 5 turns No. 20 enamel, ⅜ inch long. The 832A tripler grid circuit has 7 turns No. 22 enamel, ⅜ inch long. Its plate circuit has 1¾ turns No. 20 enamel, ⅜ inch long. The final plate circuit requires 2½ turns of the original coil, ⅝ inch long.

Crystals between 8150 and 8200 kc. are used, providing operation between 220.05 and 221.4 Mc.

— *C. R. Barrer, K2GNJ*

PUTTING THE DX-40 ON 50 MC.

HERE is the procedure used by W5BRQ, Vicksburg, Miss., to put his Heathkit DX-40 on 6. First the 40-meter oscillator coil was removed and replaced with 10 turns of No. 26 enamel on a National XR-50 form, close-wound. (The XR-50 is slug-tuned, ½-inch diameter.) Next the 10-meter buffer coil was replaced with 10 turns of No. 16 enamel, close-wound, ¼-inch diameter.

The last three turns were then clipped from the 10-meter section of the final tank coil, at the bottom of the coil and to the rear of the bottom coil spacer. The three short ends were soldered together, and to the lead going to the final-stage tuning capacitor.

The final amplifier plate choke was replaced with an Ohmite Z-50 (7-μh.) r.f. choke, and an 8.4-Mc. crystal placed in the crystal socket.

To tune the rig up for 6-meter operation, the oscillator plate circuit is tuned to the third harmonic of the crystal. Check this with a grid-dip meter or absorption-type wavemeter. Adjust the "drive" capacitor for maximum grid current to the final, about 3 ma. in this instance. Tune the final amplifier to 50 Mc. in the manner described in the instruction book. Check with grid-dip or absorption wavemeter to be sure signal is on the right frequency.

Because of the relatively minor changes involved, the rig can be put back into service on the lower frequencies with a minimum of trouble.

8. Hints and Kinks . . .

for the Antenna System

"WATERSPOUT" ANTENNAS

ALTHOUGH the "beer-can antenna" certainly caused a lot of flurry, I can't for the life of me see why anyone would want to patiently solder together a long string of tin cans, keeping them in perfect alignment, and then have only soldered joints to depend on for mechanical strength.

If you really want a cheap and rugged vertical, why not use 10-foot sections of waterspout as some of the old-timers used to do? The 2-inch pipe — either round or square — sells for 10 cents per foot out here in Washington, so a "50-footer" doesn't cost much more than five dollars.

The pipes slip together with enough overlap to assure good electrical contact. Three sheet-metal screws at each joint provide the necessary mechanical strength. As you can well imagine, it doesn't take very much time or effort to lash one of these jobs together.

A 50-foot "waterspout" antenna was used here at W7OE for several years before being replaced with a 20-foot job. The latter, mounted on the roof of the garage, has been in use for the past four years. All of which indicates that they *do* stand up quite well.

— *Howard S. Pyle, W7OE*

—···—

THOSE of us who prefer *bottled* beer have some difficulty in collecting *all* of the material for the "Budget 7-Mc. Vertical Antenna," (*QST*, Nov., 1955). However, an excellent substitute for the beer cans used by W2JTJ is the 3-inch diameter aluminum waterspout available from plumbing supply shops. The tubing comes in 10-foot lengths and sells locally at a cost of 27 cents per foot.

When using the material, it is advisable to extend the crimping at the ends of the tubes so that an overlap of 12 inches or so will exist when the sections are fitted together. Aluminum sheet-metal screws should be used at each joint to add mechanical strength. The rest of the construction is in accordance with W2JTJ's article.

— *D. R. Snyder, W7ZMG*

REMOTE TUNING OF THE CUBICAL QUAD

A GREAT help in receiving through QRM with a cubical quad antenna is being able to phase out interfering stations by adjusting the quad's reflector at the operating position. This may be done with receiving-type Twin-Lead and a 360-$\mu\mu$f. variable capacitor.

Attach one end of the Twin-Lead to the junction of the reflector and the tuning stub and the other end to the capacitor which has been mounted at the operating position in the shack. Set the capacitor at half capacitance, and then adjust the stub for maximum front-to-back ratio as is normally done.

I can adjust for front-to-back ratio over the entire 21-Mc. band with this arrangement. The forward gain remains essentially the same regardless of the setting of the capacitor, but interfering signals from the back may be reduced an average of 30 db. — *Capt. J. R. Hagen*

SEALING OUTDOOR ANTENNA CONNECTIONS

ERRATIC loading of the transmitter, or noises in the receiver, can sometimes be traced to eroded antenna connections. Some amateurs use candle wax to seal open antenna connections; however, this provides only a temporary seal. Constant beating by the weather will cause this type of seal to crack and allow moisture to enter the connection. What to do about it? Use that old piece of coax! Remove the outside jacket and shield from a piece of the cable. Strip about ½ inch of the insulation from the conductor. Holding the exposed piece of the center conductor with a pair of pliers, bring the flame of a match under the insulation at the other end of the cable. After a few seconds, the insulation will melt and start dripping off in a molten form. Hold the cable over the connection to be sealed and let the drippings fall onto the connection. When the joint is sealed, let it set for an hour or so. Now you have a sealed connection that even old man weather can't touch!

— *David L. Cabaniss, W1TUW*

SERIES OR PARALLEL TUNING WITH THE HEATH AC-1

ONE of the shortcomings of the Heath AC-1 antenna coupler is that it is parallel tuned only. This sometimes makes it difficult to feed certain antennas.

However, the coupler in use at K3BZI was very easily modified for both series and parallel tuning with a minimum of extra components. All that was used was a d.p.d.t. toggle switch and some Scotch electrical tape.

Disregarding the built-in low-pass filter switch and output indicator, which are not affected by the modification, the effective circuit of the AC-1 is shown in Fig. 8-1.

In this circuit, the inductance L_1 and the transmitter link L_2 are in series. The combined in-

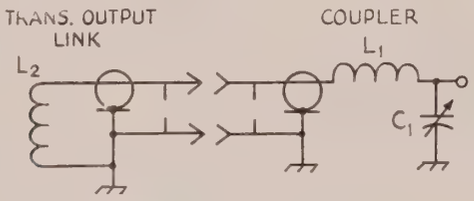


Fig. 8-1—Basic diagram of the AC-1 antenna coupler, C_1L_1—Original AC-1 capacitor and inductance.

ductances are then a parallel-tuned circuit with respect to capacitor C_1. All that is needed is insulation of rotor C_1 from the chassis and provision for a method of switching the circuit to insert C_1 in series or in parallel with L_1 as desired.

To insulate the capacitor, the coupler is removed from its case and C_1 is removed from its mounting hole in the front panel. The bushing for the rotor is insulated by making several washers of electrical tape or other thin insulating material. The washers are cut so that the center hole is a snug fit over the bushing. They are then slid over the bushing to the front mounting plate on the capacitor. After the washers are in place two or three wraps of tape are made around the bushing. The tape should be slightly wider than the thickness of the front panel. This is shown in Fig. 8-2.

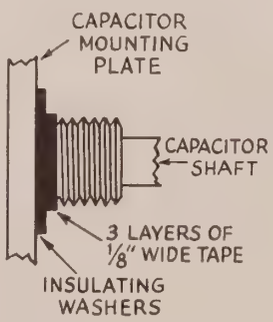


Fig. 8-2—Sketch showing modifications to C_1.

The mounting hole is then enlarged sufficiently to allow the tape to go through, and the capacitor is replaced in the panel. Several more of the washers are then placed over the bushing and pushed against the panel. These should be large enough to prevent contact between the panel and the lock nut of the capacitor.

After the capacitor is completely insulated from the cabinet, the leads from the coil to the capacitor are removed from the capacitor and the lead from the neon bulb is removed from the coil. A d.p.d.t. switch is mounted where convenient (at K3BZI the output indicator was moved from the panel to the back of the cabinet and the switch mounted in its place). The switch is then wired as in Fig. 8-3.

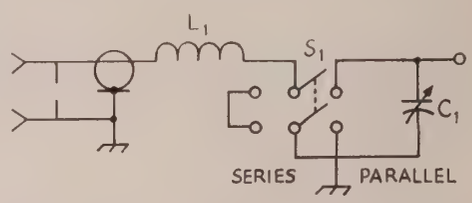


Fig. 8-3—Circuit of the antenna coupler with series-parallel tuning feature added.
C_1L_1—Original AC-1 capacitor and inductance.
S_1—D.p.d.t. switch.

The neon indicator is then capacity-coupled to the tank coil by soldering a piece of insulated wire to the base of the bulb and bending it so that it is near to, but not touching, the coil. The amount of coupling may be changed by varying the distance between the wire and the coil until the desired brilliance is attained.

This modified coupler is being used at K3BZI to load a new 40-meter vertical and the results indicate that the modification was well worth the little effort involved.

— Walter J. Bannister, K3BZI
Walter J. Stauffer, jr., K3DWY

LIGHTNING PROTECTION FOR VERTICALS

THE sketch in Fig. 8-4 shows a vertical antenna mounted above and in line with a ground pipe, thus giving spark-gap protection during electrical storms. The top vertical portion of the antenna is supported by stand-off brackets and held to these brackets by U-bolts. A piece of rubber hose or other insulating material is placed around the antenna where the brackets and U-bolts connect.

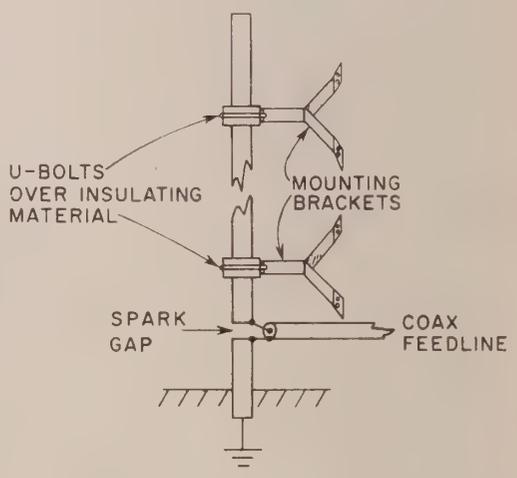


Fig. 8-4—Sketch showing the vertical antenna with lightning protection.

The spark gap should be set as close as possible, but not so close that it will break down with voltages encountered from the transmitter.

— Luke McCloud, K2DDM

ELECTRIC FENCE WIRE FOR ANTENNA USE

MANY newcomers may not be aware that some supply houses and hardware stores carry ½-mile spools of "electric" fence wire. This 18-gauge wire is labeled as being 30 per cent copper and sells for approximately $9.00 per roll. The fact that it is light in weight and is quite strong (it has a steel core) should interest the long-wire antenna enthusiast. No specific claims for its efficiency as a conductor of r.f. are made at this time, but it is known that 1000- to 2000-foot open-wire TV feed lines have been successfully made with the material. Another added feature of the wire is that the stuff is almost invisible when erected at heights of 30 to 40 feet.

An antenna using electric fence wire has been suspended here at W4ZZ for the past several months and has taken some pretty stiff winds. This radiator is 420 feet long and is supported by a pair of trees located 440 feet apart.

Incidentally, because of the low copper content, the wire does oxidize quite quickly. It is therefore recommended that the wire be treated with plastic spray before it is erected.

— *Herrick B. Brown, W4ZZ*

PERIODIC INSPECTION FOR COPPERCLAD WIRE ANTENNAS

HERE is a tip, learned from bitter experience, that should benefit any of the gang who use surplus copperclad wire for their sky hooks. Antennas made from this material require inspection once a year or so if deterioration in advance of actual breakdown is to be detected. In my own case, I *had* a nifty 340-footer about 50 feet high that was made with surplus aircraft-trail wire obtained from a bargain 3000-foot reel. After about four years of service — without inspection — trouble started. Wherever the wire came in contact with stand-offs, strain insulators or other supports, and at points where bends were necessary, the copper coating had worn through and rust had eaten into the core, thus creating about half a dozen high-resistance joints that finally broke down.

— *Wm. Plimpton, W2IXH*

MORE ABOUT COPPERCLAD WIRE ANTENNAS

THE deterioration referred to by W2IXH above can be prevented by a practice used in the electrical industry. Wherever the copperclad contacts a stand-off, strain insulator or other support, and at points where bends are necessary, it is covered with a close-wound coil of soft wire or a special wrapping intended for the purpose. The soft wire coating is most practical for ham work. It is advisable to use a wire (for the wrap) that is either the same diameter or one size smaller than the antenna wire.

It is quite a bit of work to provide for this type of protection, but it's well worth the effort if you're building a large permanent system.

— *Eugene Austin, WØLZL*

HOMEMADE LIGHTNING ARRESTERS

HEAVY-DUTY industrial fuses that have outlived their intended purpose may be quickly modified for use as lightning arresters. High-current (70 to 600 amperes) 250-volt cartridge fuses with copper blade terminals are best for the job, and it should be possible to obtain one or more of them from an electrician or the caretaker of an apartment house, a store or a factory.

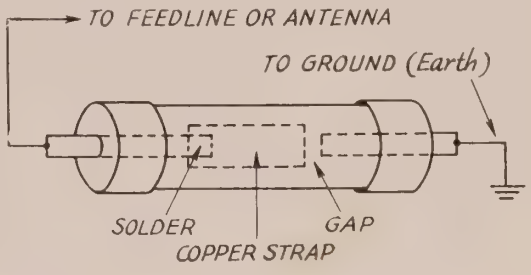


Fig. 8-5—Drawing of the homemade lightning arrester. A blown cartridge fuse and a small scrap of copper are the only materials required.

Fig. 8-5 illustrates a blown fuse revamped for arrester duty. The fuse element normally supported between the copper blades has been removed and a copper strap soldered to the terminal at the left. Notice the gap between the right end of the copper strap and the adjacent fuse terminal. Maximum protection against lightning is afforded by a gap of minimum width. On the other hand, the gap must be wide enough to prevent the arrester from flashing over when transmitter power is fed to the antenna. It is advisable to start out with a real narrow gap and then, by clipping short sections from the strap, adjust for a width that will stand up with the amplifier operating at full input.

The end bells for the fuses are fastened to the main cartridge by either rivets or self-tapping screws and, of course, these must be removed before the fuse can be opened for modification. Have a wastebasket handy during the opening-up operation so that you'll have a place to dump the lime dust packed inside of the fuse. If rivets are used in the original assembly, these may be replaced with self-tapping screws when the bells are refastened to the cartridge.

To give the arrester a real chance to work, use a short heavy lead between the ground terminal and a good ground system (earth).

— *James A. Keesler, K8EXF*

STREAMLINING ANTENNA BOOMS

HOLLOW booms used in the construction of beam antennas frequently act as air scoops during high winds. This scoop or air-trap action can lead to free turning or other undesirable motion of the beam.

Booms made with round tubing can be streamlined to suppress wind-driven movement by inserting a rubber ball in each end of the tube. Most dime stores carry a large variety of rubber balls — the type children play with — and you can usually find a size that will force-fit into the ends of the boom. — *William C. Martin, W6PLK*

STOP ROTATOR FREEZING

AMATEURS who have experienced difficulty with beam rotators freezing-up in cold weather might be interested in my inexpensive solution to this problem. Position a 150-watt light bulb just below the rotator mechanism and enclose it with asbestos paper. Connect a heavy duty power cord to the lamp and to a power receptacle. When the temperature goes down and the rotator sticks, turn on the light bulb for about fifteen or thirty minutes. The rotator will then turn "free" again.

— *John L. Spencer, KØIUC*

A NOVEL DIRECTION INDICATOR FOR ROTARY BEAMS

THE choice of a method of coupling feeders to the rotating portion of a beam usually results in a compromise. The three methods generally used are: (A) inductive coupling, (B) brushes, (C) direct feed.

Inductive coupling and brushes have the advantage of continuous rotation of the beam. On the other side of the ledger is the difficulty of adjustment of inductive coupling, and maintaining uniformity of spacing between the coupling loops. Brushes have a habit of getting dirty and also give a discontinuity in the uniformity of line impedance. Direct coupling avoids these difficulties but raises the problem of twisted and broken feeders. One attack on the problem is the use of limit switches. However, another approach to this problem has been used at W2OXR which permits continuous rotation within reasonable limits without fear of snapped or twisted feeders. Our direction indicator informs us not only where the antenna is pointing but also how many times the feeder is wrapped around the mast. The feeders are loose and can be wrapped around two or three times safely.

Our method is as follows: A transmitting synchro is connected to the worm gear that drives the main gear of an old Mims rotator. The receiving synchro in the shack is coupled to a surplus Veeder Root counter (one buck in surplus) which counts the rotations. The ratio of the worm gear to the main gear is 32:1, so we set the counter to 0 on north, so that 8 indicates east, 16 south, 24 west, 32 north again, and 40 east again. The number 64 is also north, but it indicates that the feeders are wrapped twice around the mast — a little close for comfort. The mast can also be turned west from the zero position so that 92 represents west, and so forth.

A more satisfactory arrangement would exist with a 36:1 turns ratio, for then a counter showing tenths of a rotation (available at the same price) would read directly in degrees for the first time around.

Use of this system is facilitated by having a great-circle map on the table with the counter numbers written around the outer rim, which immediately again translates the bearing into counter numbers.

This system has been in use at W2OXR for over a half year with gratifying results, and adaptations of this system should be useful to others.

— *Reuben E. Gross, W2OXR*

ANOTHER SOURCE OF FEEDER SPREADERS

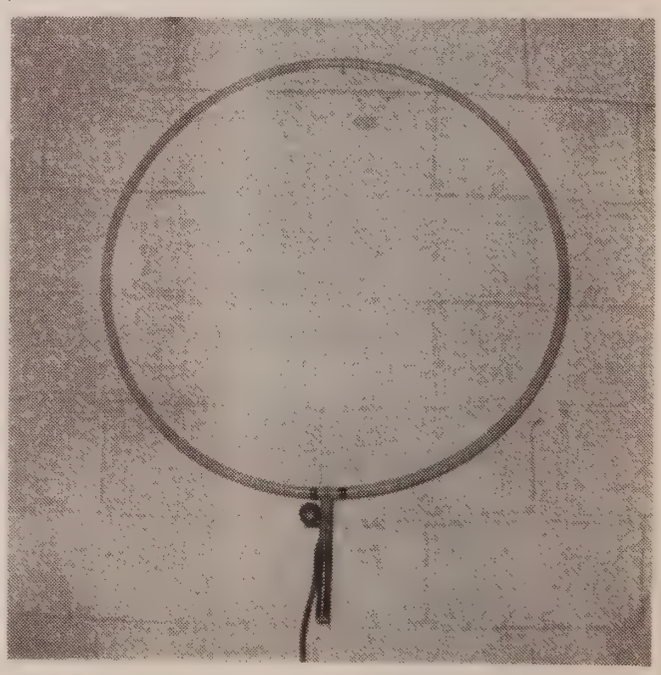
THE bakelite spools supplied with Polaroid film make very excellent feeder spreaders. The spools are approximately 4 inches long and include a slot which may be used for fastening tie wires securely in place. The light weight of the spools makes them well suited for use as the spreaders for those extra long transmission-line runs.

Incidentally, I have soaked one of these spools in water for two days, wiped it off with a dry cloth, and then found its insulation resistance (between ends) to be over 1000 megohms.

— *Gene Fry, K2CW*

HULA D.F. LOOP

SHOWN in the photograph is my revised Hula Hoop. As the name signifies, it is a direction finding loop made from the infamous hula-hoop. Mine was designed for 75-meter operation so that I could participate in the local 75-meter transmitter hunts. Here are the constructional details: First a handle had to be attached. This was accomplished by drilling a hole in the hoop tube and attaching an 8-inch piece of broom handle with a wood screw. The loop consists of 185 turns of No. 18 enamel wire with the turns spaced about ⅜ of an inch apart. A check with a grid-dip meter indicated the resonant frequency of the hoop was a bit high. Rather than add more wire, I attached a 50-$\mu\mu$f. variable capacitor in series with the coil. Now I can tune the hoop from 3.5 to 4.0 Mc. with the capacitor. The addition of a piece of low impedance coaxial cable connected to the capacitor and coil completed the Hula D.F. Loop.



K5AHT's Hula D.F. Loop

— *Bobby J. Bellar, K5AHT*

REMOVING GUY WIRE AND GROUND STAKES

WHEN you next run across a guy wire or ground stake that won't pull up after a few mighty heaves, put the automobile bumper jack to work. As long as the stake or rod has a clamp or other surface to which force may be exerted, it is fairly certain that it will move after a few strokes on the jack handle.

— *Harry M. Engwicht, W6HC*

FIELD-DAY ANTENNA MAST

SINCE not all Field-Day sites come equipped with trees of adequate height and spacing for antenna supports, here is a design for a lightweight, portable and easy-to-erect 40-foot antenna mast. The drawing in Fig. 8-6 gives most of the details. The carefully selected lumber should be free from knots and as straight as possible. The mast sections should be painted and then marked at the joints for identification when assembling. Guy wires are looped around the mast so that they can be removed easily and coiled for reuse. A four- or five-foot length of rope at the end of each guy wire facilitates fastening and adjustment.

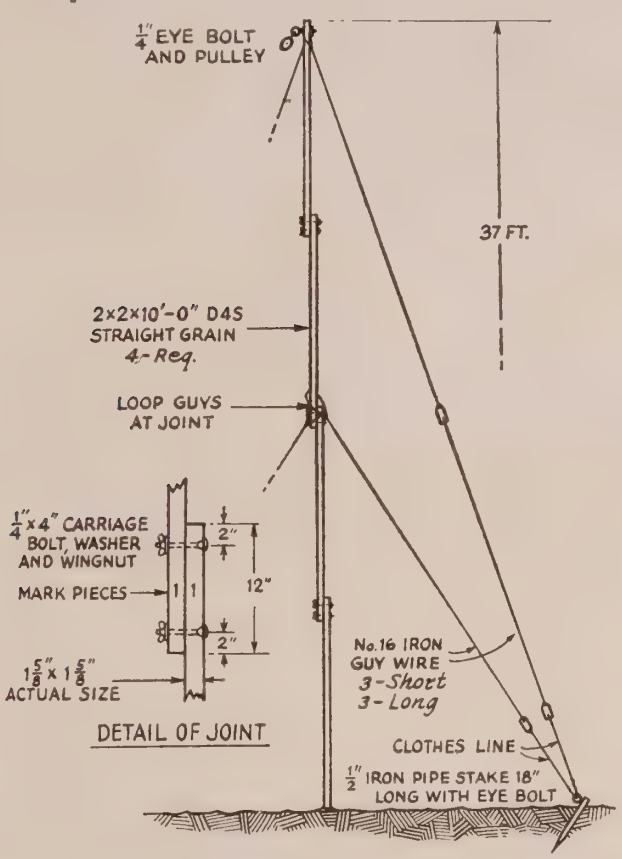


Fig. 8-6—Details of the Field-Day mast.

The mast sections should be bolted together and guys attached before erection is started. When raising the mast, two helpers on the side guys should steady the pole while another holds the back guy. When the mast is in position, the stakes should be placed at equal angles about twelve feet away from the base.

Two masts, when disassembled, can easily be carried on top of a car since they weigh less than thirty pounds apiece.

— *L. A. Cundall, W2QY*

THREE-BAND OPERATION WITH A 7-MC. GROUND-PLANE ANTENNA

BECAUSE of the growing popularity of the quarter-wave vertical, especially on 7 Mc., it may interest some of the gang to learn that this antenna can be made to do a fair job at 3.5 and 21 Mc. also. The method used to obtain 3-band operation here at W3NWA is shown in Fig. 8-7.

In the diagram, *L* is a loading coil used when the antenna is operated at 3.5 Mc. When the s.p.d.t. switch, *S*, is in the neutral position, it connects *L* in series with the radiator and the RG-8/U transmission line. In one of the closed positions the switch shorts the coil, permitting normal 7-Mc. operation of the system. The antenna will also take power at 21 Mc. when the loading coil is shorted out. In the third position, the switch connects the vertical to the grounded radial support to provide lightning protection.

In the original installation, the Premax whip was adjusted to favor operation at the low end of the 7-Mc. band. The loading coil used to resonate the system at 3550 kc. consists of 22 turns. No. 12 enameled, 2½-inch diameter, 4 inches long. The coil was cut from a 10-inch length of commercial stock which had been temporarily installed intact and then tapped experimentally during the initial stages of testing. A grid-dip meter may be used to help resonate the coil, provided the feed point (the coaxial connector shown in Fig. 8-7) is connected to the grounded radial support.

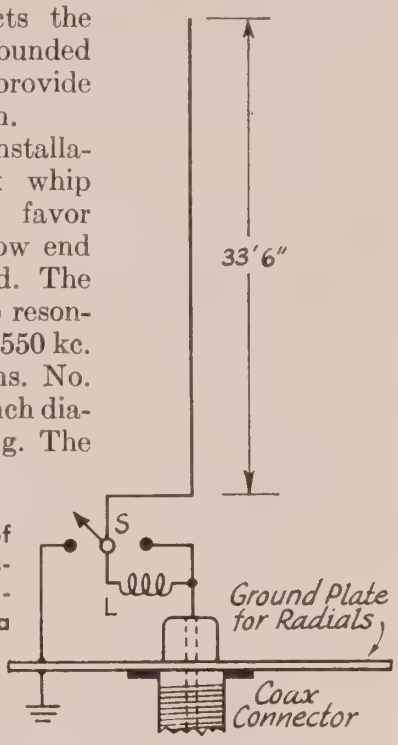


Fig. 8-7—Drawing of the base-loading system which permits 3.5-Mc. operation with a 7-Mc. ground-plane antenna.

A liberal application of Duco cement along the existing support bars for the air-wound coil will provide added strength to the assembly. One coil so treated has been exposed to the weather for an entire winter with no apparent ill effects.

In actual operation at 3.5 Mc., good reports have been received from all over the eastern part of the U. S. A., using 100 watts on c.w. Reports are consistently better than formerly received while using a random-length horizontal wire, probably due in part to the low-angle radiation from the vertical. The s.w.r., while not as low as on 7 Mc. (using the same RG-8/U feeder), is not high enough to cause trouble, provided operation is limited to a 100-kc. band centered on the frequency for which the loading coil has been resonated.

— *R. E. Young, W3NWA*

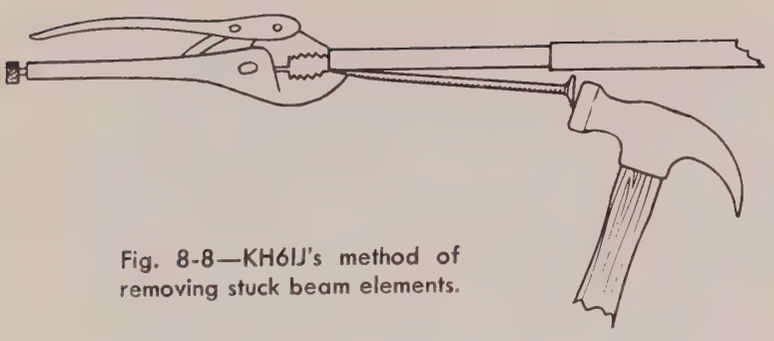


Fig. 8-8—KH6IJ's method of removing stuck beam elements.

REMOVING STUCK BEAM ELEMENTS

THERE are numerous methods for removing "frozen" telescoping beam elements and they range from the application of a blowtorch to the brute-force method of gas pliers. The following way was found most effective: Firmly clamp the end of the frozen member with a pair of vise-grip pliers as shown in Fig. 8-8. Using a hammer, tap the end of a chisel until the joint comes loose.

To prevent future freezing of telescoped elements, I coat the joint with grease and bind up with plastic tape.

— *Katashi Nose, KH6IJ*

SOME NOTES ON GUYED TOWERS

Wind, Ice and Earthquake Loads

THE loads acting on a tower are essentially the same as those acting on buildings and other structures and may be placed in three main classifications: live, dead and erection. Wind is by far the most critical live load. The design wind load is usually set up from references to U. S. Weather Bureau reports and maps for each locality. It varies from a recorded 132 m.p.h. in Miami to 49 m.p.h. in Los Angeles. Velocity is converted into pounds per square feet in accordance with accepted formulas, taking into account the increase of wind velocity with height.[1] Wind tunnel tests have shown that the total wind load should be based on the projected area of 1½ tower faces on square towers. The wind on round members may be figured as two-thirds the load on flat members. Thus the load on a 3-inch rod will be equivalent to the load on a 2-inch flat bar or angle. No attempt, by the way, should be made to design a tower to resist a tornado as the chance of a direct hit is remote and there is no assurance that even a fantastically heavy structure will survive.

Ice load is another important live load. While its occurrence is not as frequent as high wind load, a heavy ice storm or freezing rain can be very disastrous to a tower. High winds seldom occur at the same time as heavy icing. On the other hand, fairly strong winds with light ice and moderate wind with heavy ice are common. Ice from ¼ inch to 2 inches thick is the usual range used for design in the continental United States. However, ice with a thickness of 12 inches or more occurs in some isolated spots. Naturally, the presence of ice on tower members increases the projected area exposed to the wind and the weight of the ice adds to the dead load.

Earthquake load must be considered in some localities, particularly on the West Coast. This load acts horizontally and is a function of the weight or mass of the structure. Although earthquakes occur infrequently, their threat cannot be ignored.

Erection loads are also very important, especially in the case of guyed towers. Wind on the tower in some stages of erection can subject certain members to loads greater than they will receive in fully erected condition. Loads from large and heavy gin poles add to the burden of erection loads.

Dead loads include the weight of the tower members, antenna, transmission lines, ladders and platforms.

Safety Factor

The term "safety factor" is a much misunderstood and sometimes misleading term. Generally, the term is intended to mean the number obtained by dividing the failure stress of the material by the allowable stress. A more realistic definition of the term would be a relation between the elastic limit of the material and the allowable stress. The elastic limit of the material is that stress below which the material will not take a permanent set or deformation. If a material is repeatedly loaded above the elastic limit it will fail at a load far below the failure limit. A safety factor of 2½ for a guy wire indicates that the breaking strength of the guy is 2½ times the working load.

Guys

The guyed tower depends entirely on the guys to hold it vertical and, therefore, the design of the guys is of prime importance. For a tower with one set of guys, an angle of 45 degrees to the horizontal is good practice. Tall towers with multiple guys require a steeper angle in the top guy. One anchor can then serve several guys and the angle of the lowest guy will not be too flat.

Maintenance

Towers should be inspected at regular intervals, the length of time between inspections depending on weather conditions. If the tower is located in a section of the country where windy seasons have regular cycles, inspections should regularly precede these seasons. The first step in any inspection is a check of the tower connections. Almost all towers have bolted connections with some means of locking the bolts in place. During this climbing inspection the paint should be observed for rust spots. If the tower is galvanized, the coating should be inspected.

The condition of the guys should also be checked periodically. Practically all guys are made of galvanized strand and are very durable even without additional protective treatment. However, if signs of rust appear, protective treatment is a must.

— *New England Professional Engineer*

[1] Abraham, Guys for Guys Who Have to Guy, *QST*, June 1955, p. 33.

RG-8/U IN THE GAMMA-MATCH CAPACITOR

AMATEURS who contemplate installation of a gamma match may be interested in construction which uses RG-8/U coaxial cable as the inner or variable element for the gamma capacitor. The mechanical details are not difficult to duplicate and the assembly may be easily adjusted and waterproofed.

Details of the capacitor are shown in Fig. 8-9. The fixed section of the capacitor is an appropriate length of aluminum tubing having an inside diameter that will fit snugly over RG-8/U after

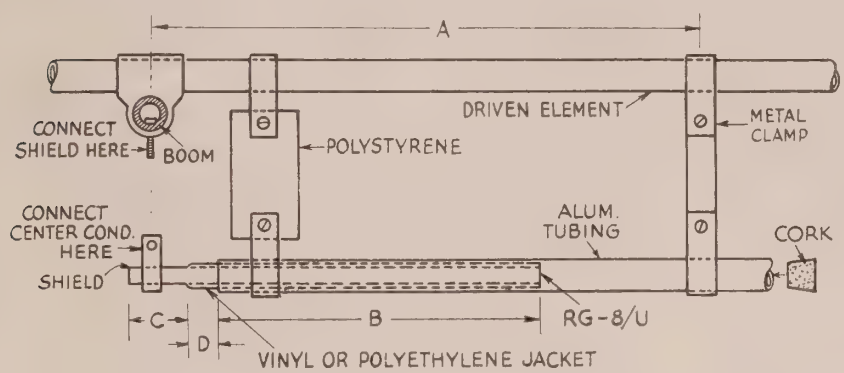


Fig. 8-9—Sketch showing the details of W3KKO's gamma matching section. The gamma capacitor is made from a length of aluminum tubing and a section of RG-8/U coaxial cable. Although the inner conductor of the coaxial cable is not used, it need not be removed.

the latter has been wrapped with good quality tape and then coated with plastic spray. Dimension A controls the length of the gamma rod, and the capacitance is determined by dimension B; the capacitance will increase as B is made longer.

One inch of the outer jacket must be removed from the input end of the coaxial element (Section C) in order that a copper band for feedline termination may be soldered in place. Be careful not to damage the shield braid when the insulation is being removed because the copper feedline terminal must be soldered to the exposed shield. After the coaxial section has been prepared and then inserted in the aluminum tubing, adjust at D for a spacing that will prevent shorting between the shield braid and the aluminum tubing.

The inner conductor of the coaxial feedline is terminated at the copper terminal provided and the shield for the line is attached to the boom. The coax line should be taped or clamped to the boom to relieve strain at the termination points. Coarse adjustment of the capacitance is made by varying the length of dimension B. Start with more than enough coax encased in the tubing and then clip off short pieces as adjustments and measurements proceed. Fine adjustment may be made by loosening the clamp at the outer end of the gamma bar and then sliding the bar back and forth over the coaxial element.

After the assembly has been adjusted for proper performance, it may be waterproofed by plugging the open end of the gamma bar with an ordinary cork and then coating the entire unit with plastic spray.

— *Wm. J. Engle, jr., W3KKO*

FIXED-STATION OPERATION WITH A MOBILE ANTENNA

WE recently moved into a new home and although the main equipment was set up and ready to go, I lacked time to work on a permanent antenna installation. Casting about for a temporary radiator, I spotted the family bus adorned with a 40-meter mobile antenna. A high-Q loading coil is used with the antenna, and reports with my 12-watt mobile rig had been pretty good. So why not hook the fixed-station transmitter to the mobile antenna?

A 25-foot length of coaxial cable was run from the shack to the car in the driveway. The mobile rig was, of course, disconnected from the antenna and a straight adapter connector (PL-258) used to couple between the coax cables running from the fixed-station rig and to the whip.

The home station runs about 70 watts for voice-modulated operation and reports are nearly as good with the mobile antenna as with the regular antenna used at the previous location. Obviously, there is some operating inconvenience caused by connecting and disconnecting the coax each time you want to operate fixed-station, but the idea does provide a suitable answer for temporary operation and it may solve the problem when a landlord absolutely forbids even No. 37 wire strung around the premises. Naturally, one should avoid slamming the car door on the coaxial extension.

One final word of caution: Don't drive off before disconnecting the coax! It is reportedly very hard on a transmitter to be dragged down the street at the end of a 25-foot length of cable!

— *Richard F. Van Wickle, W6TKA*

SIMPLE ANTENNA CHANGEOVER CIRCUIT

THE circuit shown in Fig. 8-10 uses a d.p.d.t. switch for transfer of the send-receive antenna. Notice that r.f. input terminal of the receiver is

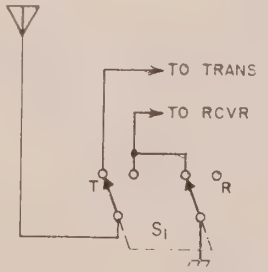


Fig. 8-10—The simple transmit-receive circuit used by ex-KN2OUI

grounded when the switch is at the transmit position. This feature of the arrangement prevents receiver overload or hold over that might otherwise be caused by the transmitter output.

S_1 should be a switch of reasonably good quality such as a knife or rotary type. Ordinarily, a toggle switch would not be suitable for the application.

— *Larry Emerson*

SPLICING 300-OHM LINE

TUBULAR 300-ohm transmission line can best be spliced by using the method illustrated in Fig. 8-11. The joint so produced is both electrically and mechanically strong and does not

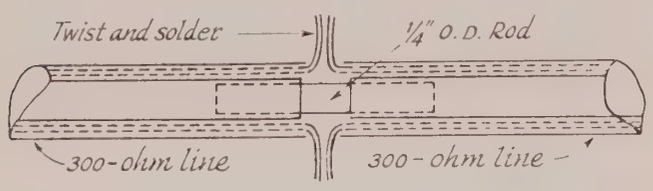


Fig. 8-11—W5DAI suggests this method of splicing tubular 300-ohm transmission line.

adversely affect the r.f. qualities of the line. Measurements made at 100 Mc. on a line so spliced show negligible loss or line discontinuity.

To make the splice, first expose approximately one inch of each conductor by cutting away the insulation. Make a clean cut at right angles to the cable when removing the sections of insulation that bond the conductors together. Next, insert a three-inch length of ¼-inch o.d. insulating rod about half way into one of the cables. Now slide the second piece of cable over the other end of the rod until it butts against the first cable. Twist the conductors together as required and apply solder. The joints may now be clipped down to a length of ½ inch or so and then bent over and laid flush against the long sides of the line. A layer or two of good tape covered with a coating of varnish or plastic spray will protect the joint against weather.

Polystyrene rod is the best material for the plug, which provides mechanical strength for the splice. Of course, since the amount of solid dielectric is physically small, it will do no great harm to use bakelite rod in place of the polystyrene material. — *Henry Smith, W5DAI*

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SECTIONS of flat 300-ohm Twin-Lead may be securely bonded together by using the joint

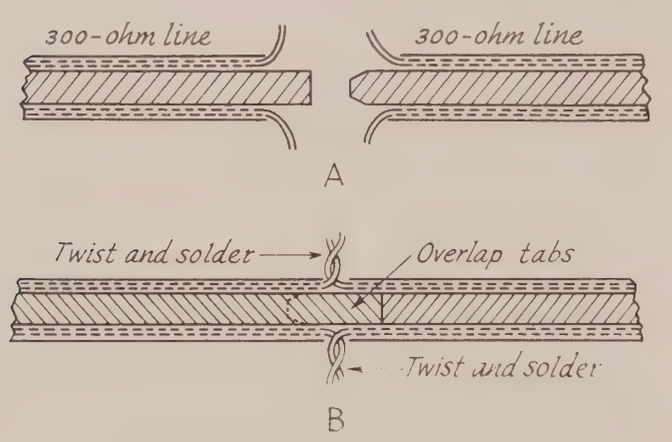

Fig. 8-12—Sketch showing the "W9BPS" method of splicing 300-ohm Twin-Lead. A shows how the sections of line are prepared for the splice. The overlapping tabs in B may be permanently bonded together as explained in the text

shown in Fig. 8-12 Fig. 8-12A shows how a tab of insulation is left protruding from the end of each cable after the insulation surrounding the conductors has been removed. These tabs are allowed to overlap as in Fig. 8-12B when the two cables are brought together for joining and soldering of the conductors. Additional strength at the splice may be obtained by fusing the tabs together with the aid of a hot soldering iron, or by cementing the tabs together. Ordinary paper staples would provide another means of joining the tabs for mechanical strength. Insulating tape covered with a weatherproofing material will keep the splice in good shape.

— *Harry Fanckboner, W9BPS*

SPLICING 300-OHM LINE: AN ADDITIONAL HINT

I HAVE had excellent results splicing 300-ohm transmission line by extending the system described by W9BPS, above. The method used here assures a strong, weatherproof joint and makes use of some ordinary kitchen-type wax paper and an electric flatiron. The XYL may immediately say "No dice," but you may guarantee her that the surface of the iron will not be damaged. The steps to be followed in making the joint are as follows:

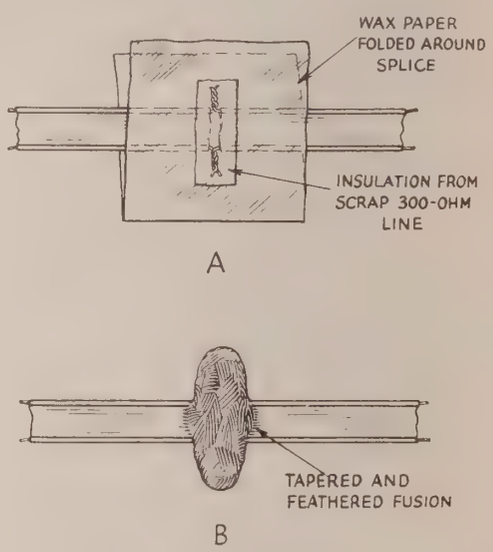

Fig. 8-13—(A) Sketch showing how WØTXP prepares a spliced 300-ohm line before applying heat with a flatiron. (B) The sturdy, weatherproof joint after excess insulation has been trimmed away.

1) Proceed through B (Fig. 8-12) of W9BPS's instructions.

2) Strip wire from scrap pieces of 300-ohm Twin-Lead, leaving only the insulation.

3) Cut insulation into 2- or 3-inch lengths.

4) Place one piece of insulation on each side of the spliced area and cover with a fold of wax paper (double thickness) as shown in A of the accompanying sketch, Fig. 8-13.

5) Apply heat — medium setting of the flatiron will do — to the wax paper until the insulation becomes molten.

6) Remove heat, allow insulation to cool and set, discard wax paper, and trim joint as illustrated in B of Fig. 8-13.

— *Denzil O. Cooper, WØTXP*

COAX-FITTINGS NOTES

It has been found that a considerable amount of energy can be lost on v.h.f. when using the 83-1SP type connector out-of-doors. The fittings are not watertight and they put a slight impedance bump in the transmission line. I have shifted all my v.h.f. connectors over to the HN-82 constant impedance type. Not only do they eliminate the bump on the transmission line but they are also watertight.

—···—

For those who need a standard male-to-male connector, here is a way to make your own. It requires two standard male connectors (83-1SP). Cut a short piece of ½-inch copper tubing about ½ inch long. Slide the copper tubing over one of

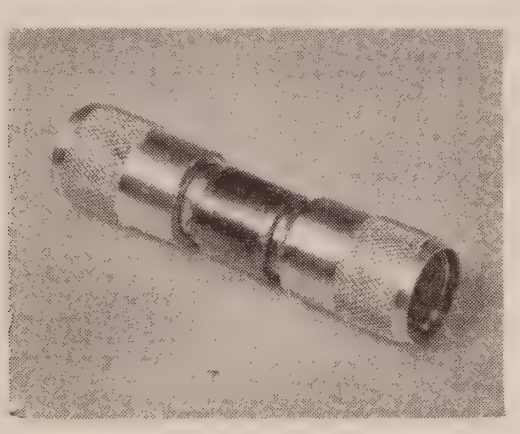

Fig. 8-14—Male-to-male connector made from 83-1SP coax fittings.

the fittings and then push a piece of No. 14 solid tinned wire through the two fittings from tip to tip. Push the connectors tight together with the ½-inch copper tubing centered on the two connectors. Fig. 8-14 shows the finished connector.

This adapter is especially convenient for connecting relays, low-pass filters, etc. directly to he 83-1R chassis connector.

— *Louis A. Gerbert, W8NOH*

MULTIBAND TANK AS A RECEIVING ANTENNA TUNER

Recently, while spending a brief vacation at a new QTH, I found myself with a few idle minutes and no ham gear ready for operation. Because there was not sufficient time for setting up a complete station, I decided to settle for just plain listening-in. Scraps of 300-ohm Twin-Lead provided material for a hastily constructed folded dipole that resonated a megacycle or two above the 28-Mc. band and the receiver was soon in operation. At least, a few signals could be heard above the high noise level that prevailed.

It was soon reasoned that the receiver needed help in the signal-to-noise department so thoughts turned toward an antenna tuner. The first thing spotted in the junk box was a National MB-40 tuner and the idea of using it for antenna matching was born then and there. A three-turn link, wound in between the two high-frequency inductors of the tuner, was connected to the 300-ohm feeder and, of course, the regular output coil was connected to the receiver input terminals.

With the coupler in place and the receiver back in operation, I was pleasantly surprised at the increase in the number of signals that could be heard and at the boost in strength of the few signals that had been tuned in previously. A few quick checks indicated that the 28-Mc. signals came up about 3 S points when the tuner was employed. Similar tests at the lower frequencies showed a gain of 5 to 8 S points when the MB-40 was used between the aforementioned antenna and the receiver.

— *Bob Barth, W7HMP*

LIGHTNING PROTECTION ON PARALLEL-WIRE LINES

Lightning protection at amateur stations using parallel-wire feedlines usually consists of a grounding switch or a homemade needle gap of some kind. The first method doesn't offer any protection for those hardy operators who keep the station going during a thunderstorm, and the second method is often a jury rig that isn't too satisfactory. K1CLD suggests that the high-voltage protectors used on telephone lines might do the trick. He says that the Reliable 20HV and 30HV units (2000- and 3000-volt breakdown, respectively) can be purchased through telephone jobbers, and he gives the address of three such suppliers:

Telephone Repair and Supply Co., 1760 West Lunt Ave., Chicago 26, Ill.

Buckeye Telephone and Supply Co., 1250 Kinnear road, Columbus 21, Ohio

Suttle Equipment Co., Lawrenceville, Ill.

The unit shown in Fig. 8-15 (the 20HV) consists of three carbon electrodes mounted on a ceramic base. Leads from each electrode are

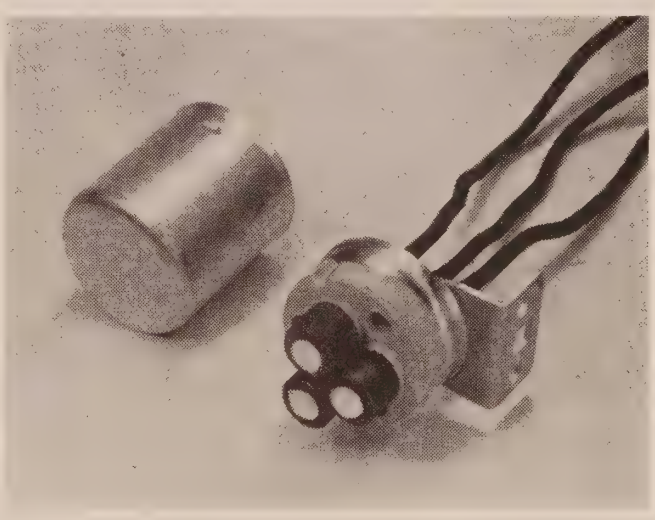

Fig. 8-15

brought out separately through neoprene bushings; the ground lead is 6 feet long and the others, which connect to the feedline, are 2 feet long. A mounting bracket and a protective aluminum housing are furnished with the units. K1CLD says the units were selling singly for a little over $3.00.

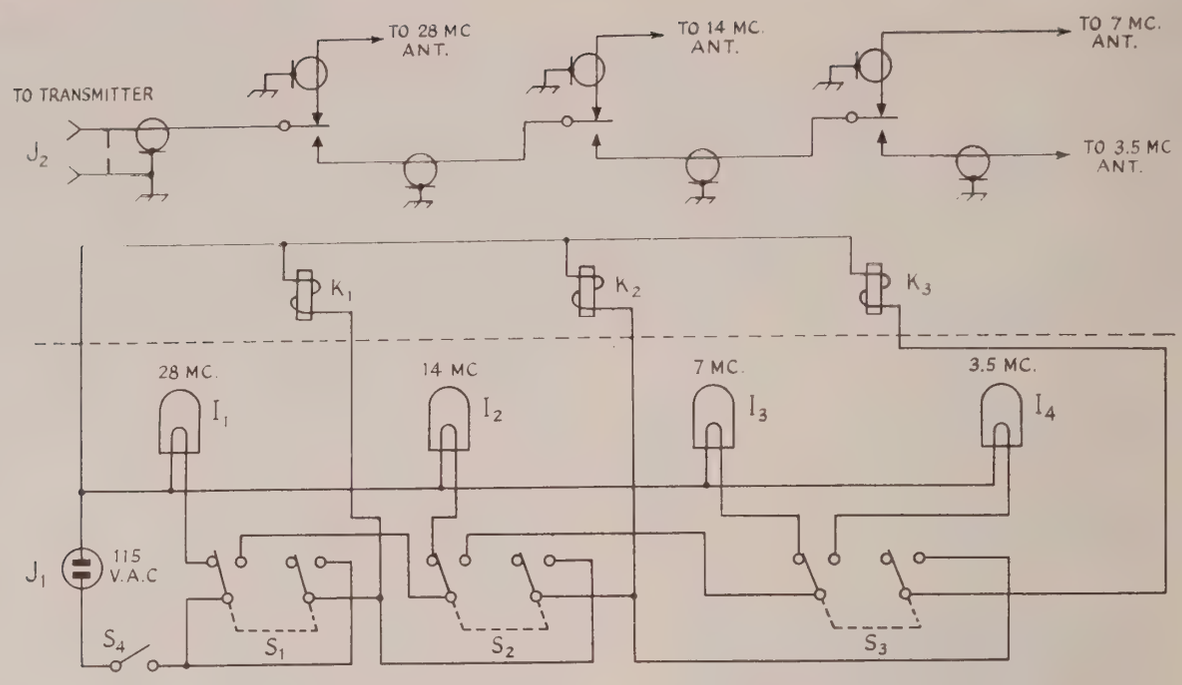

Fig. 8-16—Circuit diagram of the remotely controlled switching circuit for coaxial feedlines.

I_1, I_2, I_3, I_4—115-volt a.c. pilot lamp assemblies.
J_1—115-volt a.c. chassis-type receptacle.
J_2—Chassis-type coaxial receptacle.
K_1, K_2, K_3—S.p.d.t. coaxial relay (Advance CB/1C/115VA).
S_1, S_2, S_3—D.p.d.t. toggle switch.
S_4—S.p.s.t. toggle switch.

REMOTELY-CONTROLLED SWITCHING CIRCUIT FOR COAXIAL FEEDLINES

ANYONE using two to four coaxial-fed antennas may be interested in the "cable-saving" selector circuit shown in Fig. 8-16. This system uses a single main feedline followed by short branch feeders to replace the four long and costly cables that would ordinarily be installed between the antennas and the transmitter or shack. In addition, the circuit is interlocking to the extent that there is little chance of feeding an antenna by mistake. It is simple to operate, reasonably economical to build, and has a visual-indicator system for identifying the antenna in use.

The complete system consists of a remotely controlled head located at the operating position and a relay unit mounted outside and adjacent to the feed points for the antennas. The control section (shown below the dashed line in Fig. 8-16) uses S_1, S_2 and S_3 to control the relays and the antenna indicator lamps I_1 through I_4. S_4 is the control head on-off switch and J_1 is a 115-volt chassis-type receptacle.

The relay circuit (section above the dashed line in Fig. 8-16) uses three coaxial relays, K_1, K_2 and K_3, to connect the main feedline from the transmitter to any one of the four short cables which run to the antennas. J_2 is a coaxial receptacle which accommodates the r.f. output cable from the transmitter. Four-conductor antenna-rotor cable is used for the relay control leads which must be provided between the relay compartment and the control head.

Fig. 8-16 shows the relays in the normally closed positions and the control switches in the "up" positions. Under these conditions, and with S_4 turned on, the 28-Mc. antenna will be connected to the transmitter and I_1, the 28-Mc. indicator, will light. When S_1 is thrown "down," a.c. control voltage will be fed through to K_1 and S_2, K_1 will transfer the main coaxial cable over to K_2 and then on to the 14-Mc. antenna, I_1 will go out and I_2 will become illuminated. Bringing S_2 "down" switches the transmitter output cable over to K_3 and permits S_3 to select either the 3.5- or the 7-Mc. antenna.

Construction of the control unit may follow any design that goes well with the other gear at the operating position. The unit here at W9QUW uses red-jeweled pilot lamps identified with white decals. The relay housing is an aluminum box made weatherproof by covering open edges with plastic tape and then spraying with clear plastic. Coaxial receptacles may be used for terminating the antenna and control cables, or these leads may be brought out through grommet lined holes drilled or punched in the bottom of the box.

— Ronald Tauber, W9QUW

CENTER INSULATOR FOR FOLDED-DIPOLE ANTENNA

A SIMPLE and rugged center insulator for folded dipole antennas is shown in Fig. 8-17. The Mosley type 263S connectors are intended for coupling feedlines to TV antennas, but they beat egg insulators by a mile when used at the center of a ham-band folded dipole. One big advantage of the system is that each Twin-Lead member of the antenna is firmly clamped ahead of the point where the electrical connection is made. This relieves the strain and prevents snapping at the soldered junctions.

If high power is used, it may be advisable to solder the Twin-Lead to the metal bars. If soldering is not deemed essential, the ends of the conductors may be clamped under the screw-type terminals provided for the purpose.

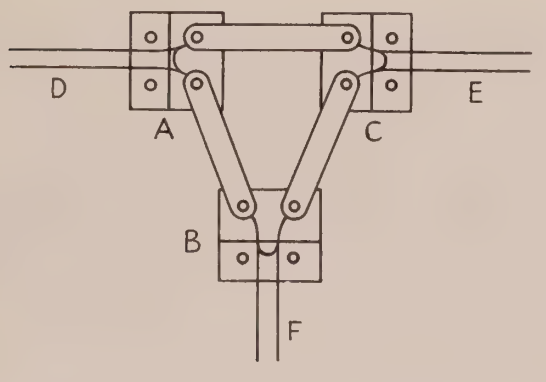

Fig. 8-17—Drawing of the center insulator described by W1CSP. A, B and C are Mosley type 263S connectors. D, E and F are radiator and feedline elements made with 300-ohm Twin-Lead.

The small amount of "fanning" caused at the junction of feedline and antenna does not appear to create an impedance problem. My antenna checks out with an s.w.r. of 1.2 to 1. And, best of all, it has stayed up under weather conditions which no other methods of construction — at least, not those tried here at W1CSP — have been able to take.

— *Marvin Norman, W1CSP*

BAMBOO FEEDER SPREADERS

FEEDLINE spreaders that are light in weight, rugged and as inexpensive as they come can be made from a bamboo pole. Very little labor is involved in making the spreaders and, when finished, you'll have some insulators that won't chip or break when bumped or dropped. One of these homemade spreaders is shown in Fig. 8-18.

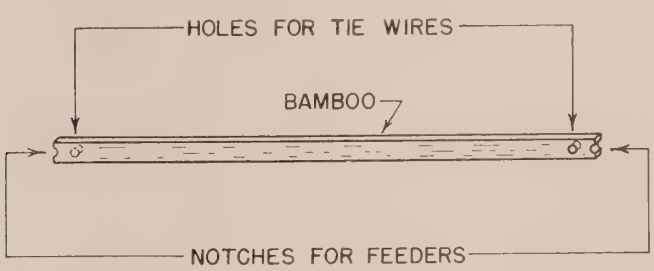

Fig. 8-18—Sketch of a neat, inexpensive and rugged feeder spreader made from bamboo.

Using a hack saw, cut sections the desired length between nodules of a bamboo pole. Make the cuts exactly at right angles and all of the spacers will be the same length. Now split the full length of the tubes with a sharp knife. Start all splits from the same end of the bamboo sections as this makes the pieces more uniform. The first split requires the application of considerable force, but from there on the lengths are easily lopped off. The spreaders don't have to be very wide, so you can get quite a few of them from a single length of bamboo of reasonable diameter.

If you are lucky enough to have an electric hand drill or a drill press, it is quick work to drill the tie holes. A round needle file can be used to notch the ends of the spreaders for the feeder wires. To make them stand the weather, dip in lacquer and hang up to dry.

— *P. C. Holden*

HOMEMADE GUY-WIRE INSULATORS

WHEN the A-frame mast to support a new 7-Mc. antenna was about to be raised, it was discovered that the supply of strain insulators had become exhausted. Waiting for delivery from a mail-order supply house was out of the question at this stage of the game and, as a result, the problem was solved — ham style — as follows:

A plank of well-seasoned hardwood was ripped into several sections measuring 1½ by 1½ by 12 inches. A groove was then cut down the middle of each side of each piece. Each length was then cut into 3-inch blocks and drilled to accommodate guy wire. Final treatment consisted of a boiling in beeswax. Fig. 8-19 is a drawing of the finished product.

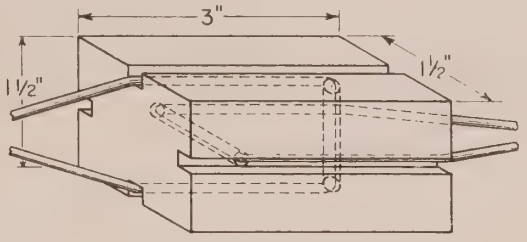

Fig. 8-19—A homemade strain insulator used by W9ALU.

— *Harley L. Christ, W9ALU*

STUB TUNING AID

THE experience of hanging on to the top of a 45-foot pole while tuning the stub for a cubical quad antenna (*QST*, January, 1955), and having the clips on the shorting bar "jump track" during adjustments, inspired me to spend a few productive minutes constructing the tuning aid illustrated in Fig. 8-20.

Construction of the tool and the manner in which it is used become clear after a glance at the sketch. The slotted block may be placed either below or above the shorting bar, depending on whether the bar is raised or lowered. By keeping the tool in alignment with the stub, it is possible to move the shorting bar evenly along stub elements without danger of either clip jumping loose.

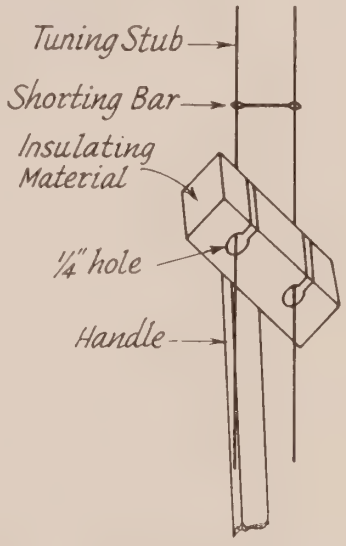

Fig. 8-20—Drawing of the stub tuning aid. The slots in the insulated block must be large enough to slip over the stub bars or wires. The wooden handle should be approximately six inches long.

— *Robert T. Riser, W5BYK*

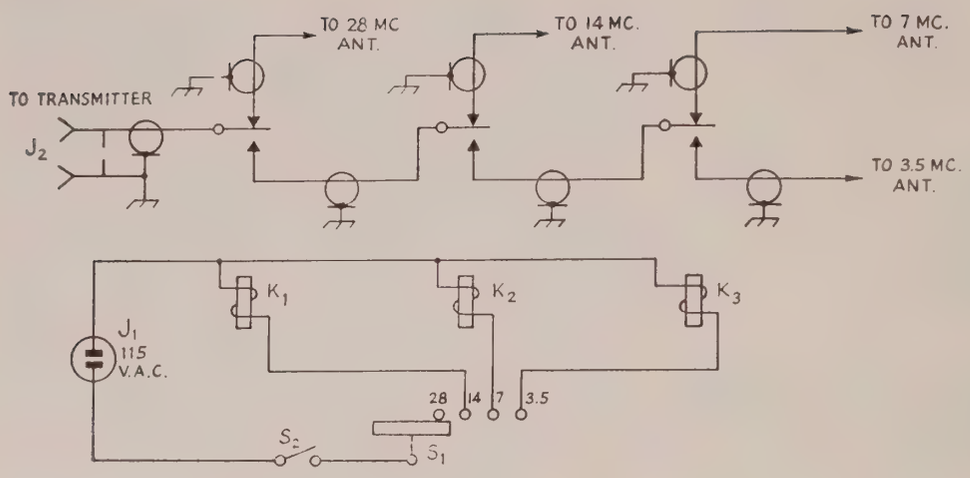

Fig. 8-21—Circuit diagram of the simplified remotely controlled switching circuit for coaxial feedlines

ANOTHER REMOTELY-CONTROLLED SWITCHING CIRCUIT FOR COAXIAL FEEDLINES

OWNERS of coaxial-fed antennas who contemplate use of the "cable-saving" selector circuit described by W9QUW on page 88 may be interested in a simplified control and indicator circuit for the system.

The relay-controlled setups I've seen usually use a progressive shorting switch wired as shown in Fig. 8-21. This arrangement has only one antenna-selector switch and is extremely simple to wire. Pilot-lamp indicators become more or less an accessory with this circuit, since the selector-switch pointer knob indicates the antenna in use.

S_1, the selector control, may be a Centralab steatite wafer section type P1S, P1SD or PA-12. Phenolic Centralab sections that will do the job are the types P1, P1D and PA-43. A s.p.s.t. toggle switch, S_2, is used as the control head on-off switch. J_1 is a 115-volt chassis-type receptacle mounted adjacent to the selector switch.

— Eugene Austin, WØLZL

TWO-METER GROUND PLANE

THE two-meter ground plane antenna described here is not only inexpensive but also has good appearance qualities generally nonexistent in ham-band antennas.

Construction is simplicity itself. A standard one-inch pipe end cap available at any hardware store makes up the base. A hole large enough to receive a ½-inch ceramic feed-through insulator is cut in the top of the cap and four equal-spaced ⅛-32 tapped holes are made in the flange. These holes should be at least ½ inch from the edge of the flange to avoid thread damage when the mast is screwed into place. The holes should be drilled with a press if possible to assure perfect alignment.

Next, five pieces of ⅛-inch drill rod are cut to length. We used the formula from the *Handbook* to determine the required length. Four of the rods are threaded for ½ inch and the fifth is threaded approximately 1½ inches.

Prepare the coax feed line as shown in the sketch. We used a solder lug with ⅝-inch inside diameter for the shield and a ⅛-inch solder lug for the center conductor. Assemble vertical, the rod with the long thread, as follows: First, a self-locking nut goes on, then the top half of the insulator. Slip this into the top of the pipe end from the outside, followed by the shield conductor lug, making sure the surface of the inside of the cap and the lug make good contact. Install the other half of the insulator, followed by a

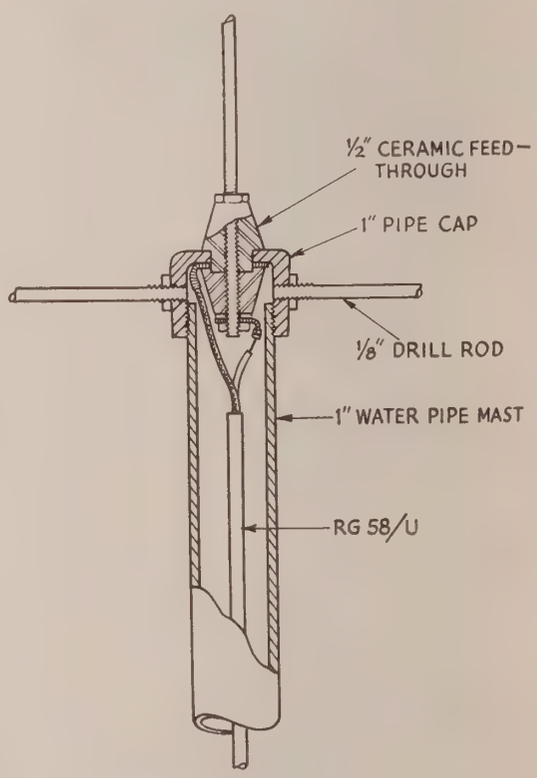

Fig. 8-22—Details of the two-meter ground plane.

washer, the center conductor terminal and a nut. Tighten the assembly with the self-locking nut on the outside to avoid twisting the conductor.

Now run a self-locking nut on each of the four remaining rods. Screw the rods into the holes around the flange and tighten up on the nuts. We use a piece of one-inch water pipe 25 feet long fastened to the side of the house at the bottom and at a point six feet from the bottom. No guy wires are needed and no feed lines are visible.

No electrical measurements of the performance of the antenna have been made here, but from an operating standpoint its performance is outstanding.

— Dale Westfall, W4FDF

A 2-BAND ANTENNA FOR 7 AND 14 MC.

HAVING used a ground plane for four years on 7 Mc. with good results, it was decided to try it as a half-wave vertical on 14 Mc. A ⅜-inch diameter copper-tubing coil, L_1, was constructed, consisting of 3¼ turns wound on a 3¼-inch form, turns spaced ⅜ inch. The coil was mounted just below the vertical element of the ground plane on a stand-off insulator, and was connected by its top end to the base of the vertical and by its bottom end to the radials. RG-8/U coax line was coupled to this coil by a link, L_2, consisting of two turns of lamp cord the same diameter as the copper coil, inserted between the bottom two turns of the tubing and fastened in place. A 100-μf. capacitor, C_1, is necessary to tune the coil to resonance in the 14-Mc. band and should be a mica rated at about 6000 volts.

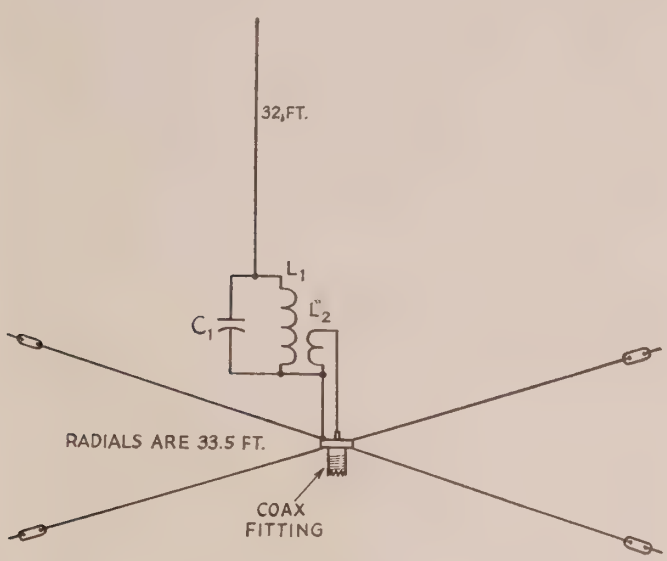

Fig. 8-23—W6TSX's two-band antenna.

While results on 14 Mc. were quite good, it was inconvenient to have to change antenna connections each time band changing was desired. In an attempt to avoid this, the antenna was tried on 7 Mc. while connected for 14 Mc. The transmitter loaded even better than with the regular ground-plane connections and reports on 7 Mc. seem to indicate that the antenna works just as well as with the original ground-plane connection.[1] No measurements have yet been made as to the s.w.r., but results on both bands have been quite satisfactory.

— Samuel J. Henderson, W6TSX

[1] Probably because the inductive reactance of the *LC* circuit at 7 Mc. just about equals the capacitive reactance of the vertical element at that frequency — a principle commonly used in trap antennas. — *Ed.*

T.R. SWITCH

HERE is a t.r. switch that I use with my Navigator transmitter and HQ-100 receiver. It's easy to build and there is nothing critical to adjust. The circuit for the switch is shown in Fig. 8-24. The output circuit, including the 180-ohm resistor, 0.002 μf. capacitor and the r.f. choke, should be shielded. Ideally, the switch would be mounted as close as possible to the final

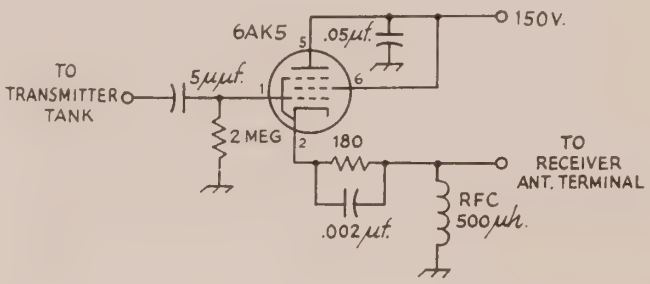

Fig. 8-24—Diagram of the t.r. switch

amplifier tank circuit to prevent stray pick-up. Be sure to use an input capacitor that will safely handle transmitter voltages. Also, use of the switch will depend on the voltage that may be safely applied between the grid and cathode of the tube.

— Ray Smith, W7UZI

"ALL-BAND" ANTENNA

FIG. 8-25 is a sketch of an "all-band" antenna system that I have been using with success for some time. The idea is not a new one, having appeared in *QST* at least 10 years ago. However, I feel that there are many newcomers since that time who would be interested in a simple system that can be fed with a single 70-ohm transmission line.

The arrangement consists of dipoles, cut for each band and connected in parallel at the center. Although I have not checked standing-wave ratios, the results seem to indicate that it gets out as well as a bunch of individually-fed doublets. If you haven't tried it, you're in for some surprises.

— R. L. Cope, W8MOK

[EDITOR'S NOTE: As with any system of this type, special care must be exercised in reducing low-order harmonic output, since any harmonic energy fed to the system will be easily radiated.]

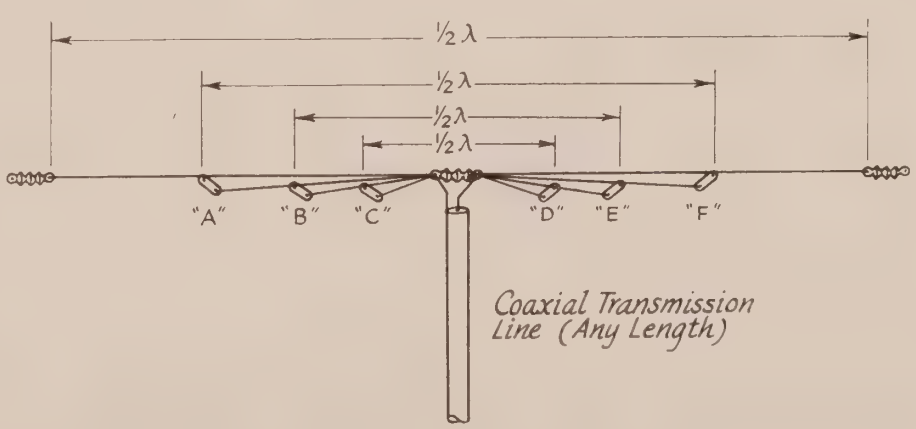

Fig. 8-25—Sketch of W8MOK's "all-band" antenna. Egg insulators are used at points "A" through "F."

A SIMPLE ANTENNA-SWITCHING ACCESSORY

THE need for a convenient method of quickly connecting either a receiver or transmitter to any one of four coaxial feed lines led to the development of the simple switching circuit shown in Fig. 8-26. The impedance characteristic of this inexpensive system may not be 100 per cent perfect, but the average amateur, operating on frequencies below 30 Mc., can usually tolerate a slight *bump* in the transmission line in exchange for a *dip* in cost.

Connectors J_1 through J_4 of Fig. 8-26 provide for inside-the-shack termination of four coaxial feed lines. S_1 is a selector switch used to connect any one of the lines to the antenna change-over relay, K_1. The normally-closed contact of K_1 is connected to the receiver jack, J_6 and the normally-open contact of the relay is connected through the r.f. ammeter to the transmitter jack, J_5. The control switch for the relay may be remotely located at the operating position. The ammeter is not a necessary component to the

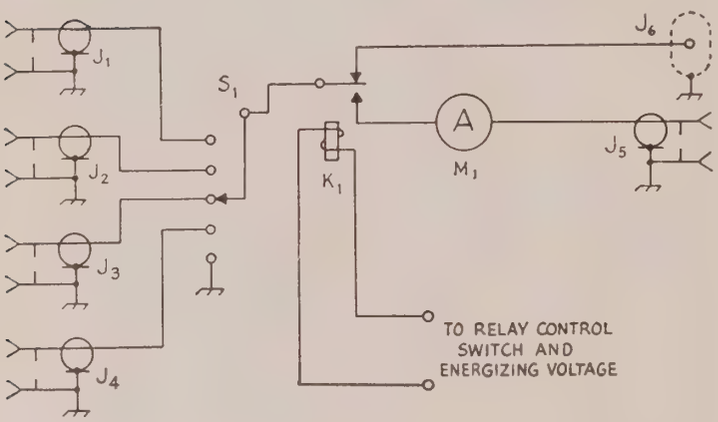

Fig. 8-26—Circuit of the simple antenna-switching accessory used by W2EEJ.

J_1-J_4, J_5—Coaxial receptacle (SO-239).
J_6—Phono jack.
K_1—S.p.s.t. normally-open antenna relay.
M_1—R.f. ammeter; see text.

circuit (connect the relay directly to J_5 if the meter is not used), but it is well worth including.

An ordinary type of selector switch, preferably ceramic, may be used in the circuit for handling the output of low- and medium-power transmitters. If the transmitter used with the accessory is a high-power affair, it is advisable to use a heavy-duty switch such as that found in a surplus BC-365 tuning unit.

Any available metal box large enough to accommodate the jacks, meter, relay and switch may be used as a housing for the circuit. J_1 through J_6 may be mounted on the rear wall of the box and the other components should be arranged to provide for the shortest possible leads throughout the circuit. Use fairly stiff wire for all connections and avoid loops or wire *dress* that will increase stray capacitance or result in shorting. To prevent inadvertent connection of the transmitter to the normally-closed contacts of K_1, use a phono jack (J_6) for the connections to the receiver.

If a low-pass filter for TVI suppression is to be used, it should be installed between the transmitter and the antenna switch in normal fashion. It is advisable to label or otherwise mark the various feed lines and the jacks with which they mate to avoid confusion or improper connection.

The r.f. ammeter serves as a handy indicator for tuning and as a continuous check of the efficiency of the transmitter, particularly if original readings are noted for future reference. It will probably be observed that maximum output occurs with the final tuned slightly off the plate-current *dip*, and optimum grid drive and plate-loading conditions can be quickly determined by observing the meter. Naturally, the meter range — full-scale reading in amperes — required will be determined by the transmitter power-output level.

In use, an additional convenience is the ability to change antennas while receiving, resulting in a modified diversity type of reception which often helps to overcome fading. *Caution:* Remember to reset the switch before transmitting to avoid operating the final without a load.

— *Herbert Greenberg, W2EEJ*

TRANSFORMERLESS VERSION OF W3DM'S T.R. SWITCH

ENTHUSIASM about installing the electronic transmit-receive switch (*QST*, June, 1957) in a portable transmitter was temporarily dampened by the improbability of being able to secure one of the broad-band output transformers in time for Field Day. However, after some reflection, the problem was solved by modifying the circuit to eliminate need for T_1 of the original layout.

As shown in the circuit, Fig. 8-27, low-impedance output for coupling to the receiver is obtained by operating the type 6AH6 as a cathode follower. Naturally, the gain in a circuit such as this is less than unity. However, this factor does not offset the advantage afforded by using

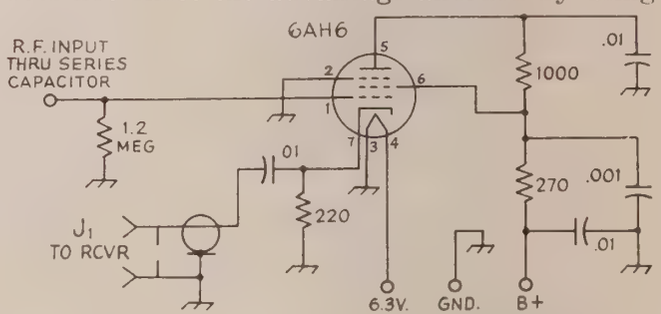

Fig. 8-27—Circuit diagram of the cathode-follower t.r. switch used by W3NF. Resistances are in ohms, resistors are ½-watt composition; capacitors disk ceramic. Capacitances are in μf. The connection to the transmitter tank should be through a series capacitor whose value is

$$\text{computed as } C(\mu\mu f.) = \frac{2500}{\text{d.c. plate volts.}}$$

the extra tuned circuit ahead of the receiver input, and the ability to conveniently use a good transmitting antenna for receiving purposes.

— *Edward Hart, W3NF, W2ZVW*

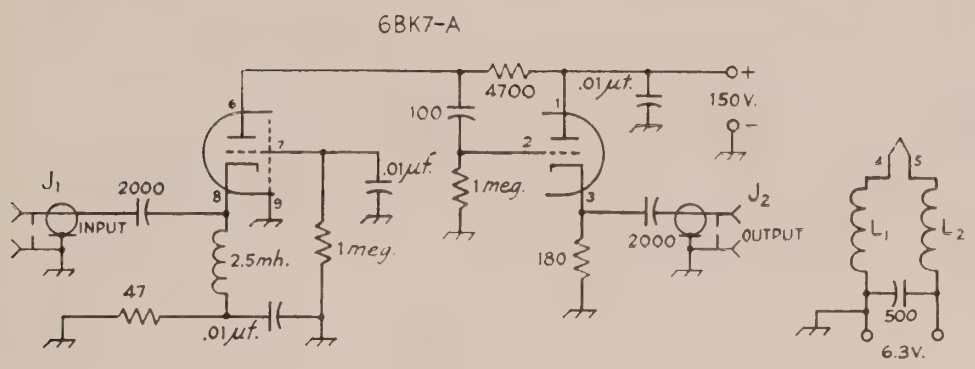

Fig. 8-28—Circuit diagram of W8EUJ's t.r. switch. Unless otherwise indicated, capacitances are in μμf. Resistances are in ohms, resistors are ½ watt. L_1 and L_2 are each wound with 30 turns No. 24 wire to a diameter of 3/16 inch.

T.R. SWITCHES

MODIFICATION of my 100-watt station for fast break-in brought up the antenna switching problem. A t.r. switch seemed to be the best answer, so one was designed.

The simplicity of the unit built is shown by the circuit diagram, Fig. 8-28. Since it could be added to existing control units, some other "120-watt table-top rig" amateur may be interested in the circuit.

A grounded-grid input stage (switched by grid rectification) *R-C* coupled to a cathode-follower output stage, provides a broad-band low-impedance t.r. switch suitable for use with coaxial cable. The unit has some gain as shown. If needed, for long lines or to make up for resistive isolation, more gain can be had by increasing the plate resistance of the first stage to 6800 ohms or more.

The 6BK7A tube is a good choice for this application. Designed for cascode operation, it has a good heater-to-cathode voltage rating. More important is an internal shield connected to Pin 9 which very effectively isolates the two triode sections. With no power to the t.r. switch the receiver sounds dead.

My model is a separate unit with its own booster-type transformer, selenium rectifier and other power supply components built on a 3½ × 5-inch aluminum sheet chassis and housed in a 4 × 4 × 5-inch sheet-metal can. Construction is similar to B & W t.r. switch. I have no way of checking power-handling capabilities, but from the tube ratings this switch should handle as much power as the other units I have seen. A phono jack in the transmitter end of the low-pass filter provides a convenient point for connection to the r.f. line.

After installing this t.r. switch several interesting developments were noted. Hash from the final amplifier (parallel 807s) had to be eliminated. A clamp tube circuit was added to help the fixed bias cut plate current completely off. Zero-beating is a little more tricky, requiring less r.f. gain in the receiver. And finally, it is quite a surprise to learn how many hams pick my operating frequency to tune up on. I can hear them now!

— *Charles E. Quick, W8EUJ*

—···—

THE t.r. switch shown in Fig. 8-29 is my adaptation of a circuit designed for another purpose and described by ZL4GP on page 48 of *QST* for July, 1955. Although the switch is only slightly more complicated than the simple unit developed by W9LSK (*QST*, May, 1956), it does operate without presenting a constant loss to received signals through the 3.5–30-Mc. range. In fact, the circuit shows some gain at these frequencies.

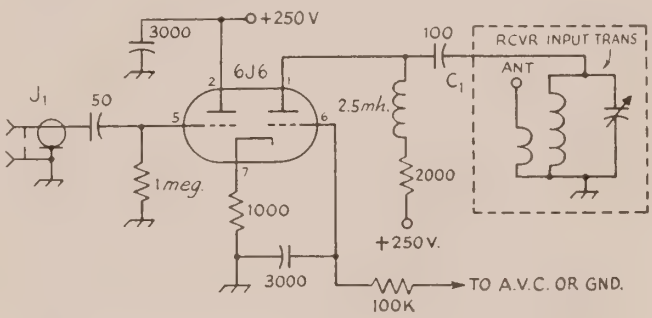

Fig. 8-29—Diagram of 11DAJ's simple t.r. switch. The switch is designed for low-impedance input (coaxial cable) and high-impedance output. Capacitances are in μμf., resistances are in ohms, resistors are ½ watt.

The switch is designed for low-impedance coaxial-cable input and high-impedance output. Because of the latter characteristic, it is important that the switch be built *into* the receiver with its output coupling capacitor connected directly to the secondary of the receiver input transformer.

— *Carlo Winspeare, I1DAJ*

UNBALANCED TO BALANCED FEED FOR LOW-IMPEDANCE MULTIBAND ANTENNAS

IN *QST* for June, 1956, W6EBY described a balun-type coupler for use between a coaxial feed-line and a balanced antenna such as a half-wave dipole. Although the system as described makes use of an individual antenna for each band of operation, it is perfectly practical to use the same method for coupling 75-ohm coaxial cable into the center of a balanced multiband trap-type antenna system.

Here at W3BRQ, we run a length of 75-ohm coax from the pi-network output tank to a balun located out on the roof in the general vicinity of the feed point for the multiband antenna. The balun, made from a pair of relatively inexpensive B & W type 3975 coils, provides a match between the long run of coax and a short length of 75-ohm Twin-Lead that connects to the center of the antenna.

— *Tony Gitt, W3BRQ*

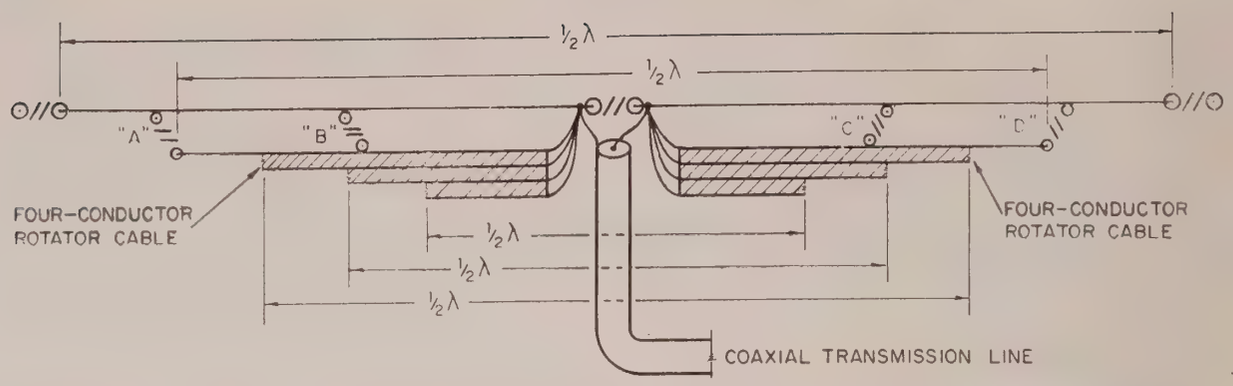

Fig. 8-30—Drawing of W9DOS's multiband antenna for 3.5 through 28 Mc. Individual dipoles for 7, 14, 21 and 28 Mc. are made from lengths of four-conductor rotator control cable. The 3.5-Mc. antenna, made with copper-weld wire, is used to support the dipoles for the higher frequencies. A single length of 73-ohm coaxial cable is used to couple to all five antennas.

USING FOUR-CONDUCTOR ROTATOR CABLE IN PARALLELED DIPOLE ANTENNAS

THE easily constructed multiband antenna using several dipoles, each cut for a different band, connected in parallel and fed with a common feedline has been previously described by at least four authors.[1,2,3,4] The latest of these articles described a four-band system using lengths of 300-ohm ribbon transmission line as the dipole elements. Although this idea does lead to simplified construction, it does not carry the easy-to-do-it theme quite as far as does the system used here at W9DOS.

A sketch of a five-band antenna is shown in Fig. 8-30. The point of interest is that the four dipoles for 7 through 28 Mc. are made from two lengths of four-conductor rotator cable. These lightweight elements are supported by a half-wave dipole cut for 3.5 Mc. Copperweld wire is recommended for the 3.5-Mc. radiator because it will stand the strain of supporting the other antennas without breaking or stretching. The 7- through 28-Mc. elements may be attached to the 3.5-Mc. antenna by means of tape or string, or a number of lightweight strain insulators (A, B, C and D in Fig. 8-30) may be used for the purpose.

The two lengths of rotator cable are first trimmed to a length suitable for use as a 7-Mc. dipole. The No. 2, 3 and 4 conductors of each length of cable are then shortened by removing excess wire and insulation to provide elements for the 14-, 21- and 28-Mc. antennas, respectively. The outside ends of the individual dipoles are left floating, and the inside ends are twisted together and soldered to the 3.5-Mc. antenna as shown in the drawing. The common coaxial feedline for the five antennas may be any convenient length.

— *Sigmund J. Wysocki, W9DOS*

[EDITOR'S NOTE: An antenna of this type will respond readily to harmonics and submultiples of the transmitter output frequency. It is therefore especially important that these frequencies be suppressed *before* they reach the antenna.]

[1] W9YPQ, "Hints & Kinks," *QST*, June, 1937.
[2] W8MOK, Page 91, this volume.
[3] Berg, "Multiband Operation with Paralleled Dipoles," *QST*, July, 1956.
[4] Richard, "Parallel Dipoles of 300-Ohm Ribbon," *QST*, March, 1957.

SAVE CABLE IN MAKING PARALLEL DIPOLE ANTENNAS

THE previous Hint describes a multiband antenna using 4-conductor rotator cable. Assuming parallel dipoles are desired for 40, 20, 15 and 10 meters, most hams might purchase a length of multiconductor cable about 70 feet long and trim it equi-distant from the center to the appropriate length of each dipole. However, an original length of only 45 feet, cut as shown in Fig. 8-31, will do the job with a saving of 25 feet of cable.

— *E. R. Hardy, W1HJL*

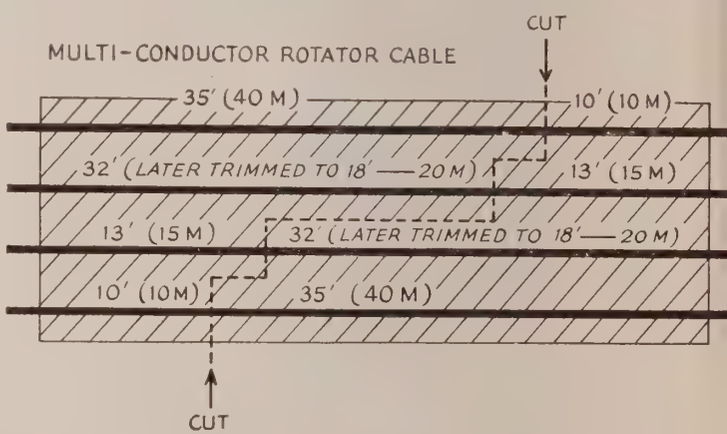

Fig. 8-31—W1HJL's method for saving cable when constructing a multiple dipole from four-conductor cable.

"UMBRELLA FOR TWO;" NOVEL GROUND-PLANE ANTENNA FOR 144 MC.

I HAD wanted to build a cheap-and-easy ground-plane antenna ever since the two-meter craze hit the Beaver Valley Gang. However, it took some activity on the part of local canines to get me started. After they had torn the XYL's umbrella to shreds, they left me with the prettiest set of ready-made two-meter radials you ever saw!

Paint was scraped from the inside ends of the ribs and these thoroughly cleaned areas were bonded together (soldered) with a length of flexible shield braid. A hole to accommodate the vertical section of the antenna was drilled in the top of the umbrella assembly. A 20-inch length of brazing rod fed with coaxial cable was used as the radiator.

One of the nice features is that I can still open and close the umbrella for convenient installation and transit. Furthermore, you don't have to be a drinking man to get the materials!

— *Rollyn W. McMahan, W3ECQ*

9. Hints and Kinks . . .

for the Mobile Rig

USING 12-VOLT DYNAMOTORS WITH 6-VOLT CHARGING SYSTEMS

Recently a surplus 12-volt dynamotor was acquired at very nominal cost because there is little demand for these units. Immediately, the problem arose as to how the dynamotor could be put to use for mobile operation without extensive and expensive modification of the auto electrical system. The addition of a relay and an auxiliary battery to the existing system provided the solution.

Fig. 9-1 shows how a 6-volt d.p.d.t. relay is wired to permit feeding 12 volts to the dynamotor whenever the push-to-talk switch is activated. With the switch open and the relay in the normally closed position, the two batteries are connected in parallel and both receive charge from

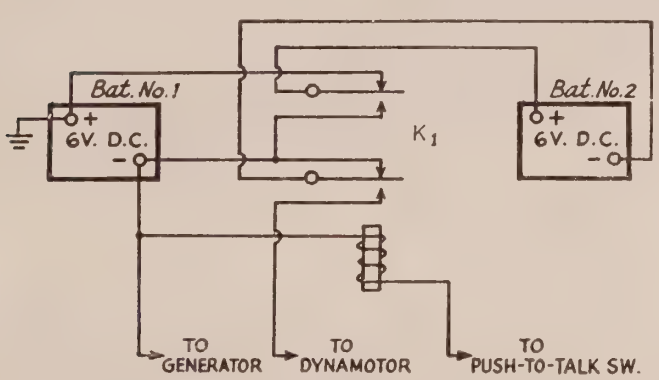

Fig. 9-1—Diagram of the 12-volt electrical system used by W4ZMZ/8. K_1 has contacts rated at 35 amperes.

the car generator. With the *talk* switch in the on position, the relay connects the batteries in series. Battery No. 1 continues to receive charge when the series circuit is employed.

Filament and relay voltages are taken from the No. 1 battery to keep the load on No. 2 as light as possible. It has been the writer's experience that the auxiliary battery will stay charged as long as normal periods of receiving, transmitting and driving are involved.

— *Edward Matthews*

CONVENIENT METHOD OF MOUNTING MOBILE GEAR

By using hinges — the type having removable locking pins — for the support of dash-mounted mobile gear, it is possible to remove and install equipment with a minimum expenditure of time and effort.

Fig. 9-2 shows the hinge-support method of mounting. One half of a hinge is fastened to each side of the mobile unit. The companion sections of the hinges are appropriately located under the dashboard. Use self-tapping screws at the

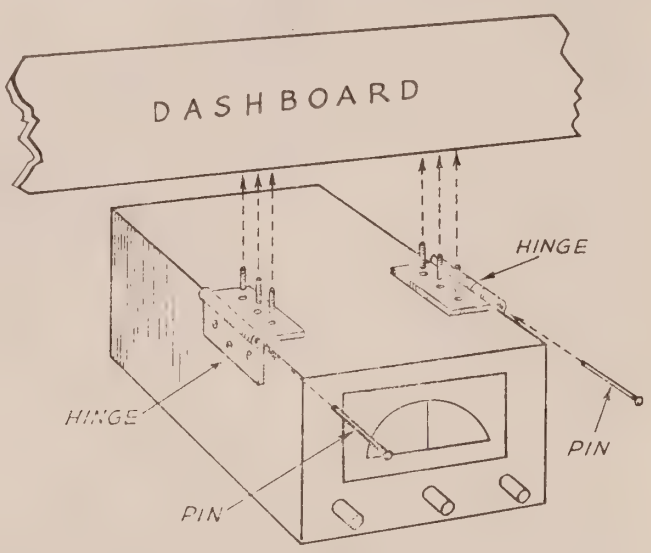

Fig. 9-2—Sketch showing the hinge method of mounting mobile gear.

sides of a unit, and machine screws, lock washers and nuts to hold the dash-mounted members in place. On heavy equipment, it may be advisable to provide additional support by means of a brace or bracket located at the rear of the unit.

To remove or install equipment, merely pull the hinge pins. Another feature of the system is that very little space is used by mounting supports, thus permitting several pieces of gear to be mounted in a row without need for wide space-wasting gaps.

— *Myron D. Weisberg*

KEYING THE VIKING MOBILE TRANSMITTER

THE use of c.w. in mobile operation is becoming increasingly popular because it usually assures reliable communication even when the bands are badly crowded. Although several of the commercial transmitters provide keying facilities, the popular Johnson "Viking" was designed solely for phone operation. Fortunately, it is a relatively simple job to revamp this rig for c.w. In my own particular case, the job was speeded up by the assistance of Bill Karsten, K4BUR.

The Viking has a bias supply which delivers about 25 volts negative to the grids of the 6AQ5 buffer/multiplier, frequency multiplier, 807 final and modulator tubes. This bias prevents excessive plate current when excitation is removed from the final and, as a result, the transmitter may be keyed by opening and closing the cathode circuit of the buffer/multiplier. Fig. 9-3A shows how a closed circuit key jack, J_1, may be wired into the cathode circuit of the 6AQ5. The jack must be insulated from ground and should be shunted with a 0.01-μf. disk capacitor.

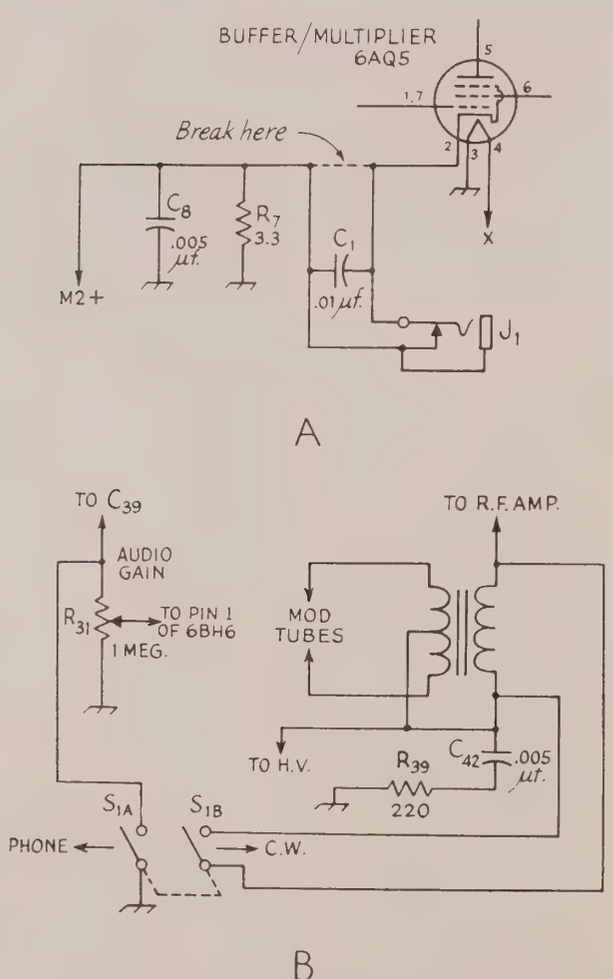

Fig. 9-3—Circuit diagrams showing the connections to a key jack (A) and a phone-c.w. switch (B) for the Viking mobile transmitter. Components other than C_1, J_1 and S_1 are all original parts of the transmitter and are labeled with Johnson identifications (see operating manual for the transmitter).

Fig. 9-3B shows how a d.p.s.t. toggle switch may be connected for use as a phone-c.w. switch. In the c.w. position, the switch grounds the high side of the audio gain control and shorts the secondary of the modulation transformer. In 6-volt models of the transmitter, it is practical to use S_{1A} as a heater on-off control for the audio tubes instead of connecting it across the gain control. However, the wiring arrangement of 12-volt models makes it difficult to install S_{1A} as a heater switch and the circuit of Fig. 9-3B should therefore be used.

J_1 may be mounted on the front panel directly to the right of drive control, and S_1 may be placed just to the left of the coupling control. Drill the necessary mounting holes with care so as not to damage components already mounted in the panel area, and be sure to provide clearance between the new parts and the outer edges of the panel so that the chassis can be slipped back into the cabinet when the modification is completed.

Signal reports received while using c.w. with the Viking have all been T9. There is some feedthrough from the oscillator with the key open, but it is noticeable only at extremely close range. Both v.f.o. and crystal control have been used and, even under the most trying road conditions, the stability leaves nothing to be desired.

— Cdr. Gay E. Milius, jr., W4NJF

[EDITOR'S NOTE: With improper wire dress, it is conceivable that the installation of J_1 will result in either transmitter instability or decreased output from the buffer/multiplier. Should either of these difficulties occur, it will be advisable to move C_8 (original component) directly over to the cathode pin of the 6AQ5, or to install a new disk capacitor between Pin 2 of the socket and ground.]

NOTES ON THE PE-101-C DYNAMOTOR

THE PE-101-C dynamotor has recently been available on the surplus market at very reasonable prices. With the increasing popularity of the new 12-volt automotive electrical systems, the 12-volt primary winding on this dynamotor makes it worth looking into.

Investigation reveals that the PE-101-C dynamotor is equipped with two *identical* high voltage windings. One of these windings gives 400 volts at 135 ma. as stated on the nameplate. Incidentally, the bottom end of this winding is grounded to the dynamotor frame. The second winding is connected in series with the first winding to give the 800 volts at 20 ma. By reconnecting the two windings, a variety of voltages and currents is possible. For example, the two windings may be connected in parallel to give 400 volts at 155 ma., or they can be connected in series and operated at 800 volts and 77 ma. If desired, the two windings may be used separately, giving two separate 400-volt power supplies at 77 ma. each. The current drawn from each winding can be varied as long as the total power drawn from the dynamotor does not exceed 62 watts. Since the above are continuous duty ratings, they may be increased by about 20 per cent for intermittent duty such as normal amateur mobile operation without danger of overloading.

— L. R. Langley, W8DSX

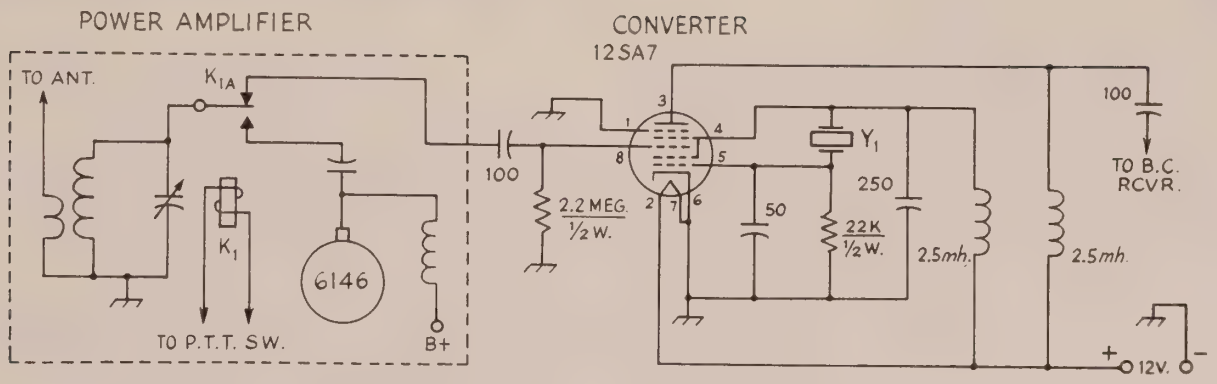

Fig. 9-4—Circuit diagram of W7NPV's simple mobile converter. The dashed lines enclose r.f. amplifier (transmitter) components. Resistances are in ohms. Capacitances are in $\mu\mu$f. K_1 is the push-to-talk relay, and Y_1 is a 3000-kc. crystal.

SIMPLE 12-VOLT MOBILE CONVERTER FOR 75 AND 40 METERS

After purchasing a new automobile having a 12-volt electrical system, I was faced with the problem of how best to receive 75 and 40 meters for a minimum expenditure. It was necessary that any ham gear added be quite small, and desirable that it use parts from the junk box.

Inspection of the car broadcast receiver revealed that it contained transistors and 12-volt tubes, the latter being the type designed to operate with the plate and screen voltages supplied directly from a 12-volt storage battery. Since there was no vibrator power supply — or no other convenient source of high voltage for a converter — I decided to try the simple 12-volt circuit shown in Fig. 9-4. Performance of the converter compares favorably with some of the more advanced or complicated units.

A type 12SA7 pentagrid converter tube is used in the circuit, but a miniature 12BE6 will work as well. One of the new 12-volt tubes — 12AD6 or equivalent — might be the best choice if the junk box doesn't contain one of the older types.

The tuned input circuit for the converter is the plate tank for the r.f. final in the transmitter. This circuit is switched back and forth between converter and transmitter by contacts K_{1A} of the push-to-talk relay, K_1.

Crystal frequency is 3000 kc. which places the 75-meter phone band between 800 and 1000 on the broadcast receiver dial. When operating on 40 meters, the second harmonic of the crystal is used and the broadcast dial is tuned from 1200 to 1300 kc. If crystal activity appears to be sluggish, the 250-$\mu\mu$f. capacitor may be replaced with one of higher value to strengthen oscillation.

Placement and wiring of components is not especially critical, but the converter is built into the transmitter and is near the final amplifier and the push-to-talk relay. Short lengths of hookup wire are used for leads terminated at contacts K_{1A} and, of course, it's advisable to use coaxial cable between the converter and the broadcast receiver. — *Vernon Phillips, W7NPV*

SUPPRESSION OF AUTO-GAUGE INTERFERENCE

Mobile fans may be interested in my recent experiments with noise suppression in various Ford vehicles.

After reducing ignition and regulator noise to a tolerable level, the remaining interference was quite severe. With the help of a coaxial feed line tied to the antenna terminals of a 50-Mc. receiver, it was determined that most of this noise was coming from the electrical oil-pressure gauge (motor block unit). The electrical temperature and gas gauges were also identified as sources of noise. Interference created by these three instruments was reduced by the installation of 0.01-μf. disk ceramic capacitors between the gauge terminals and ground. Lead length of the disks should be made as short as possible and soldering at the grounded ends is recommended.

After the work on the company vehicles had been completed, the above noise suppression method was tried out on the writer's personal car which carries a 4-Mc. mobile installation. Results obtained were most gratifying. W4MGT also reports favorably on the oil-gauge bypassing stunt. — *Robert A. Thomason, W4SUD*

MOBILE HINT: A PENCIL WHEN YOU NEED IT

Ever hunted for a pencil while mobiling? Keep one on the top surface of the dashboard. A piece of magnet from an old speaker will stick to any convenient location on the dash. And an ordinary wooden pencil with about 3 wide-spaced turns of baling wire or equivalent (not copper) around the shaft will cling to the magnet. For long trips a piece of scratch paper can be placed beneath the magnet, which will hold the paper firmly enough for quick operation notes.

— *Harold A. Thomas, W5HJM*

REDUCING NOISE IN TRANSISTORIZED AUTO RECEIVERS

Some models of the transistorized car broadcast receivers are plagued with motor noise interference. Motorola has recognized this problem and has made availble a high temperature high capacitance electrolytic that connects directly to the ignition coil. The unit bears part number AK-300, has a capacitance of 1000 μf. and nets for less than $2.00.

— *Donald S. Middleton, WØNIT*

TRANSISTORIZED B.F.O. FOR MOBILE USE

THE schematic of a compact transistorized b.f.o. for mobile use is shown in Fig. 9-6. The circuit is a variation of that appearing in several issues of *QST*, but the method of obtaining power for the unit is somewhat unique. Although an inexpensive type CK722 transistor is used, the oscillator is adequately stable for use in converting an automobile broadcast receiver for c.w. reception. The b.f.o. may be constructed for use with receivers having either a 262- or a 455-kc. i.f.

When first used, the b.f.o. circuit was installed to take d.c. input power from the hot filament lead in the auto radio. This method of installation resulted in hash modulation of the oscillator signal — by the vibrator — that no amount of filtering would cure. This condition was easily remedied by powering the b.f.o. with the 10 to 15 volts of well-filtered d.c. available across the cathode bias resistor of the audio output stage.

Component values for the circuit are not especially critical, but stability of the oscillator is improved by connecting the base of the transistor to the cathode tap on the b.f.o. transformer rather than to the grid terminal. This results in an improved impedance match as compared to that obtained with normal transformer connections, and also decreased loading on the tuned circuit.

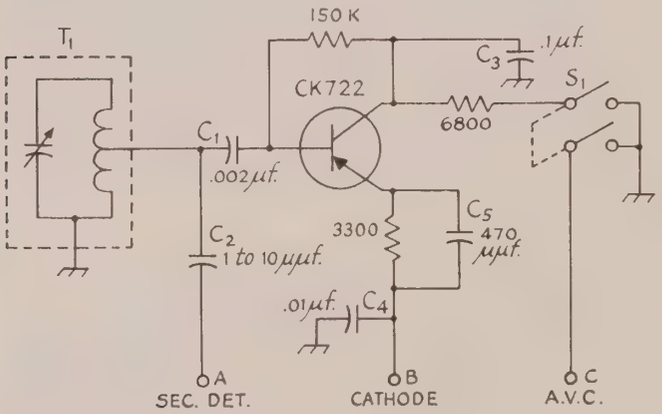

Fig. 9-6—Circuit diagram of the transistorized b.f.o. unit. Resistances are in ohms; resistors are ½ watt. T_1 is a 252- or 455-kc. b.f.o. transformer (see text). S_1, a d.p.s.t. toggle switch, is the oscillator on-off control. Terminals A, B, and C connect to the second detector, audio-amplifier cathode and a.v.c. line, respectively of the broadcast receiver.

Catalogues on hand indicate that 252-kc. b.f.o. transformers may not be too widely available. One homemade substitute for the commercial unit is a good quality 2.5-mh. r.f. choke of the 3- or 4-section variety, tapped between the first and second sections at the ground end (see Fig. 9-6) of the winding. This inductor should be shunted with a fixed "silver mica" of approximately 150 μμf. and a 100-μμf. variable padder.

To avoid complication in the schematic, and because it is difficult to show the several circuits that will be found in various types and makes of b.f.o. transformers, Fig. 9-6 shows only the bare essentials of a typical unit. If the one on hand is

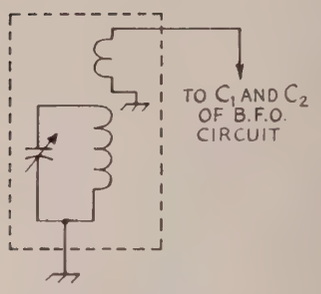

Fig. 9-7—Transformer connections for WØPME's transistorized b.f.o. when T_1 has a feedback winding instead of a cathode tap.

permeability tuned, or if it has fixed capacitors not shown, it may be used in the circuit as long as it tunes to the i.f. frequency. However, some transformers have a feed-back winding instead of a cathode tap and, in this case, the connections shown in Fig. 9-7 should be used in coupling T_1 to the transistor. — *Davis A. Helton, WØPME*

SQUELCH SYSTEM FOR THE GONSET G-66

MOBILE fans who wish to add a squelch system to the popular Gonset G-66 receiver should consider using the circuit shown in *The Mobile Manual for Radio Amateurs*, page 84 (also *QST*, October, 1952). This particular job works exceptionally well.

After installing the squelch, taken *as is* from the *Mobile Manual*, it was found necessary to reduce the audio gain of the receiver. This was done by disabling the triode section of the 6AW8 in the receiver. The modification involves the rewiring of a component or two, but does not affect the resale value of the receiver because the original hookup can be put back in place with just a few minutes' work.

Parts involved in the modification are identified as C_{29} and C_{30} in the Gonset schematic. These two capacitors are mounted on a terminal board near the socket for the 6QWS. Fig. 9-8 shows the *before* and *after* wiring of the capacitors. Notice

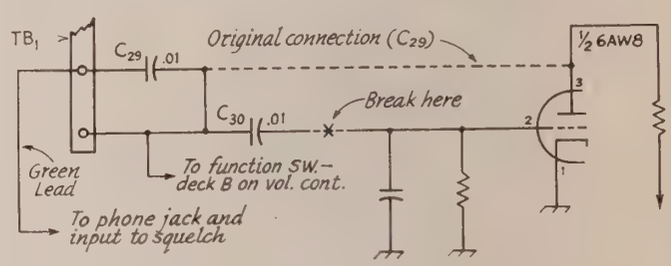

Fig. 9-8—Partial circuit of a G-66 modified to permit installing a squelch system, C_{29}, C_{30} and TB_1 are referred to in the text. Capacitor and resistors not identified are original components that need not be rewired.

that the plate end of C_{39} is disconnected from Pin 3 of the tube and reconnected to the input side of C_{30}. The connection between C_{30} and the grid of the triode is broken at "X" as indicated. TB_1 is the terminal board referred to above.

The squelch circuit may be built in a small box fastened to the side of the receiver. The 8 ma. or so drawn by the squelch tubes may be taken from the receiver power supply.

— *Melvon G. Hart, WØIBZ*

"STACKING" CRYSTALS FOR CONVENIENT SELECTION

FEW mobile operators have a convenient storage system which permits rapid selection of crystals for the most frequently used frequencies. One method that has worked out exceptionally well in the W1TNS mobile installation is shown in section A of Fig. 9-9.

Crystals cut for local nets and other popular frequencies are arranged in stacks and then bound together with Scotch tape. Frequencies may be printed on paper tabs attached to the ends of the holders where they are readily visible, and the stacks may accommodate two or more crystals.

The crystal socket must ordinarily be mounted on the outside of the panel when this system is used. Make sure that the socket is at least 7/16-inch

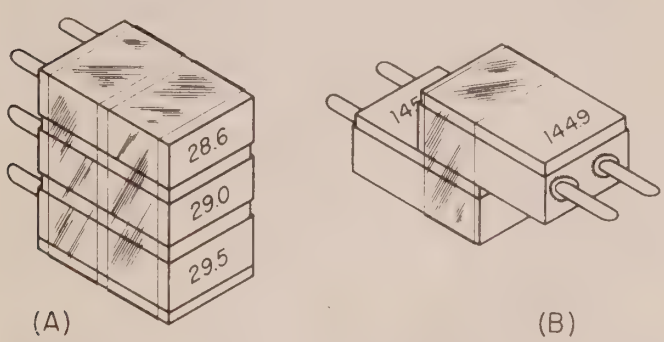

Fig. 9-9—Two methods of "stacking" crystals for rapid selection and ease of identification. (A) Method used by W1TNS. (B) System suggested by W3ZRQ.

deep so that prongs of crystals *out* of the socket will not press against the panel and prevent the active crystal from seating firmly in place.

— *Chuck Newton, W1TNS*

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SECTION B of Fig. 9-9 shows the crystal stacking method used here at W3ZRQ. Scotch tape is used for clamping the holders together and for binding the frequency-identification tabs in place. The crystal socket may be mounted on the rear of the panel because clearance for the prongs of crystals not in use need not be provided.

If you care to, the stack may be made *four* high by adding a crystal to both the top and the bottom of the pile. Orientate the holders in the form of a cross so that the sets of pins are 90 degrees apart. A good grade of plastic cement may be used for bonding the holders together.

— *Allen R. Breiner, W3ZRQ*

WINDSHIELD-WIPER MOTOR FOR TUNING WHIP LOADING COILS

AN electric windshield-wiper motor, mounted adjacent to the base of a mobile whip, provides a convenient and inexpensive means of tuning a roller-type base loading coil. It is very easy to arrange for reverse rotation of the motor because the field winding is brought out to a switch. Wiper motors can usually be obtained from an auto junk yard for a dollar or two.

— *Johnny Johnson, W2ZYX*

MOBILE HINT: PRUNING LOADING COILS

A NUMBER of laborious mount-the-coil and dismount-the-coil operations associated with pruning a set of mobile antenna loading coils may be eliminated by using the following procedure.

After the first coil has been resonated with the aid of a grid-dip meter, carefully observe the setting of the meter and then remove the coil from the antenna. Next, connect the coil in parallel with a 50-$\mu\mu$f. variable capacitor and, by tuning the latter, adjust the circuit to resonance at the exact frequency measured when the coil was mounted in the whip. The value of capacitance so arrived at is not of major importance, but it is equivalent to that effectively imposed across the coil by the antenna. Therefore, this external or test capacitance may be used to simulate antenna capacitance when other loading coils are being trimmed for resonance. In other words, coil adjustments may be made *on the bench* without involving repeated mounting tasks. The following precautions should be observed when using the system.

Couple the meter through a single-turn loop to the base of the antenna when grid-dipping a mounted coil. Couple the meter as loosely as possible when measuring an unmounted coil shunted with the test capacitor. Do not depend on meter dial calibration in either case because the oscillator frequency will probably pull some during measurements. G.d.o. frequency may be accurately checked by listening to the signal with a receiver of established calibration.

Hand-capacitance effects should be minimized while bench-testing an *LC* circuit by using a reasonably long insulated control shaft or tuning tool. A plastic housing over the capacitor will prevent accidental detuning after initial adjustment. Short leads between capacitor and coil are desirable and, of course, the *LC* circuit should rest on an insulated surface — not a metal work bench — while being adjusted.

— *Art Fenster, W2EXH*

NOVEL VENTILATING SYSTEM FOR MOBILE UNITS

ADEQUATE cooling for some of those compact under-the-dash units can be provided for — without blower — simply by running wiper hose to the wiper line or to the manifold. Frequently, enough air will be drawn in through crevices around the cover, shaft openings, etc., of a unit to make unnecessary the drilling or punching of any special ventilation holes or louvers.

— *Harry E. Adams, W9JX*

MORE ABOUT THE NOVEL VENTILATING SYSTEM FOR MOBILE UNITS

WHEN using the ventilating suggested by W9JX, above, it is advisable to avoid connection to the vacuum line from the intake system. Otherwise, you may run into valve trouble caused by an improper air-gas mixture from the carburetor.

— *Bill Norman, W5TXM*

CLEANING VIBRATOR CONTACTS

An article published in *Bell System Practices* (American Tel. & Tel. Co.) contains information on cleaning of vibrator contacts that should interest amateurs who use these units in mobile and portable gear. The purpose of the procedure is to free the contacts of the film that develops after the vibrators have been through a period of inactivity. This film can accumulate on the contacts of new vibrators as well as on those which have seen service. The film can generally be broken down and the vibrator rendered operative by the contact cleaning described below.

Connect 115 volts a.c., a 40-watt lamp and the vibrator in series in accordance with Fig. 9-10.

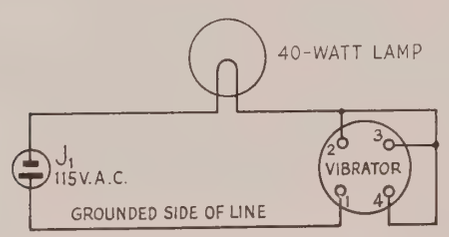

Fig. 9-10—Diagram of the vibrator-contact cleaning circuit submitted by W7OUS. J_1 should preferably be a polarized type connector.

If a polarized plug is used it is preferable that the identified blade (the wide blade of a parallel-blade type) be connected directly to the vibrator socket and the other blade to the lamp socket. Vibrator connections are:

Pin No.	*Internal Connection*
1	Reed and one end of winding
2	Pull interrupter contact
3	Inertia interrupter contact
4	Free end of winding.

Apply 117 volts a.c. to the vibrator through the 40-watt lamp for one minute. The a.c. will drive the vibrator to good amplitude regardless of the condition of the contact surfaces. The mechanical beating and the voltage applied to the contacts (limited by the 40-watt lamp) will generally break down any film in one minute of operation. The vibrator may be left in this test circuit for as long as 15 minutes without damage.

Safety precautions should be observed at all times.

— LeRoy S. Parris, W7OUS

MOBILE ANTENNA MOUNT

The following method of mobile antenna mounting that I use may be helpful to others. Remove one of the rear bumper guards and cut off the top of it with a hacksaw. This cut is made so that a flat plate welded over the cut will provide sufficient area for mounting the antenna base mount. After the plate is cut and welded in place, the guard should be filed smooth. Drill the mounting holes for the base mount in the plate. The guard is then rechromed (this cost me $3.35) and mounted on the bumper. The modified guard can always be replaced with a standard one whenever desired.

— Vincent N. Capasso, jr., K6ECV

MOBILE-TRANSMITTER METERING HINT

The circuit shown in Fig. 9-11 utilizes a simple d.p.d.t. toggle switch to perform several mobile-transmitter switching operations. One half of the switch is used to connect a d.c. milliammeter into either the grid or the cathode circuit of a power-amplifier tube. Simultaneously, the other section selects either the receiver or the transmitter power supply as the source of plate voltage for the oscillator-driver tube.

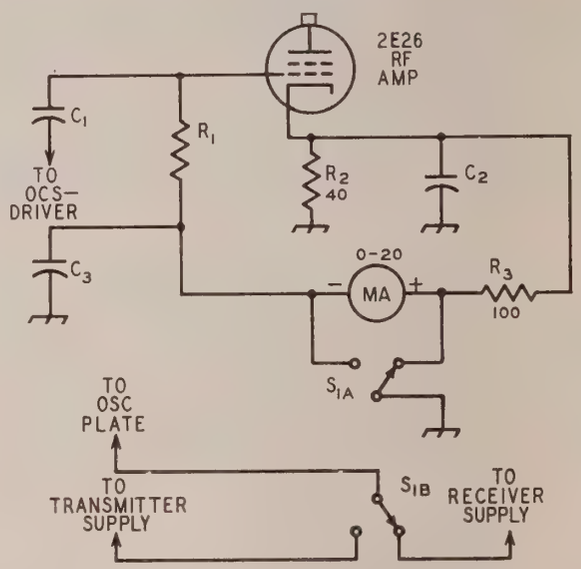

Fig. 9-11—Circuit diagram of the meter switching system suggested by W4DPV.

When S_1 is in the position shown in the diagram, and with the transmitter power supply turned off, the oscillator will take power from the receiver supply and the meter will indicate amplifier grid current. This arrangement is ideal for tune-up or zeroing-in adjustments because it leaves the r.f. amplifier without plate power. In the second position, S_1 connects the meter into the amplifier cathode circuit, and returns the oscillator plate circuit to the transmitter power supply.

The series resistor, R_3, prevents the low-resistance of the milliammeter from shorting out the voltage developed across the amplifier cathode resistor, R_2. Of course, it also divides the cathode current path with the result that the meter registers appreciably less than the total cathode current. However, this presents no problem once the meter has been checked and calibrated against a direct reading. The latter may be made by shorting R_3 and reading total cathode current with an appropriate milliammeter. R_3 has no part in the grid-circuit operation and a direct reading of amplifier grid current is therefore registered by the 0–20-ma. meter.

The component values shown in Fig. 9-11 are used with a 2E26 final. A little arithmetic will show that the effective value of cathode resistance (for the amplifier) is reduced to less than 30 ohms when the meter is switched over to the final and, as a result, the system causes no appreciable drop in amplifier plate voltage. C_1, C_2, C_3 and R_1 are typical amplifier components.

— Harry Hawkins, W4DPV

A HOMEMADE BUMPER MOUNT

IT IS ASSUMED that every amateur has access to an "Armstrong" milling machine (file, that is), one very worn hack-saw blade, and an electric drill. These tools will suffice to build this bumper mount, aside from the welding and brazing.

Make a cardboard template of the bumper contours at the point where you wish to mount the antenna, taking care that the top line is parallel to the ground — unless you want a real rakish job pointing aft! Using the template, refer to Fig. 9-12 and lay out the pieces. Allow an extra half inch in length for the top piece (A) for the hook which goes over the top of the

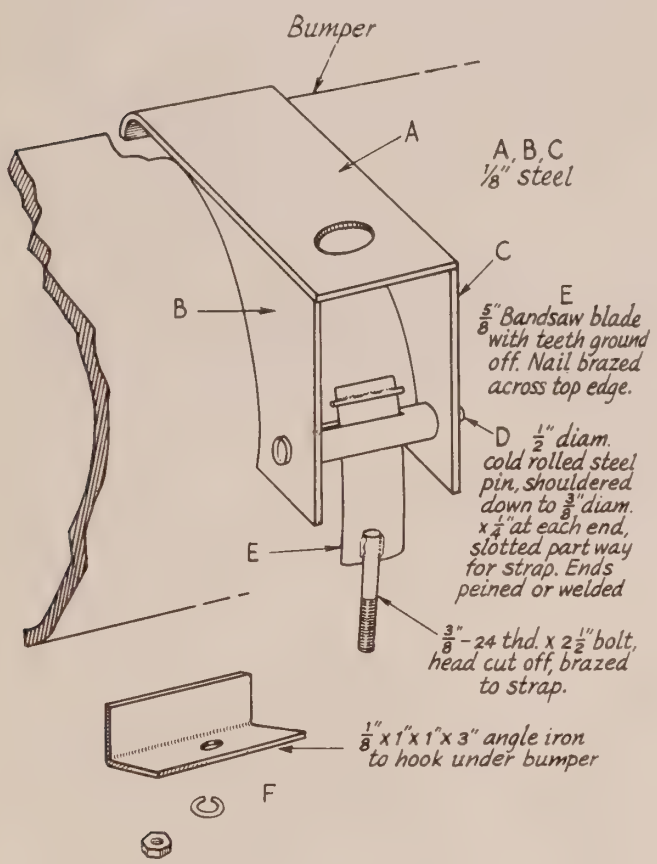
Bumper
A
A, B, C
1/8" steel
C
B
E
5/8" Bandsaw blade with teeth ground off. Nail brazed across top edge.
D 1/2" diam. cold rolled steel pin, shouldered down to 3/8" diam. x 1/4" at each end, slotted part way for strap. Ends peined or welded
E
3/8"-24 thd. x 2 1/2" bolt, head cut off, brazed to strap.
1/8" x 1" x 1" x 3" angle iron to hook under bumper
F

Fig. 9-12—Sketch of the homemade bumper mount used by W8QMI.

bumper. This hook can be hammered cold with the piece held in a vise. Clamp the two side pieces (B and C) together and drill the holes for the slotted pin (D). Make up the strap-and-bolt piece (E) allowing extra length of strap.

At this point it is well to take all the parts out to the car for a trial assembly. If all is well (three hands *would* come in handy here), mark the location for the stop on the strap. Braze the stop to the strap, put the strap in the slotted pin, insert the pin in the side pieces and pein (or weld) in place after making certain the slot is directed so there will not be a kink in the strap. Now the top can be welded to the side pieces and the job is ready for paint. I used a ¾-inch hole in the top plate and made a bushing and two large washers of formica to insulate the antenna.

The mount is locked in place on the bumper by means of the bracket, washer and nut illustrated in section F of Fig. 9-12.

— E. W. Koch, W8QMI

5-BAND MOBILE ANTENNA

HERE is a center-loaded mobile antenna that will work on 5 bands and there's no need to get out of the car for switching or adjustment when changing bands. I used a Master All-Band Coil, but any type with the correct number of turns may be used. The antenna could be called a multiple-loaded antenna since the proper *LC* sections resonate the antenna for whatever band is being used.

The diagram of the antenna is shown in Fig. 9-13. The capacitors should be mica or ceramic and must have a voltage rating high enough for whatever power is being run. Solder the four capacitors in series and connect the 40-$\mu\mu$f. capacitor to the bottom end of the coil, using a lead of about 6 inches. Now tune the mobile receiver

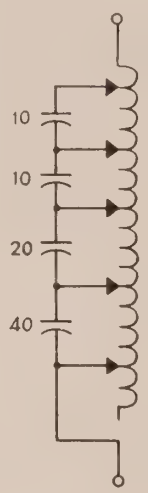

Fig. 9-13—Circuit of the multiple-loaded mobile antenna. The capacitors are in $\mu\mu$f.

to 10 meters and slide the top end of the top 10-$\mu\mu$f. capacitor along the coil until the signals peak. Do the same on 15 meters with the next 10-$\mu\mu$f. capacitor and so on down the bands until the last tap is peaked for 75 meters. A little readjustment of all the taps may be needed after the first run, due to some interaction between the connections. Solder the connections and the antenna is ready for use. *— Rev. Francis A. Peterson, W7RKI*

B.C. BAND HALO

BECAUSE I wanted to use my 6-meter halo for broadcast reception I tried connecting the halo to the car b.c. set. Reception was poor and only a few very strong stations were copiable. To remedy the situation, I installed a 400-$\mu\mu$f. ceramic capacitor C_1 between the ground end

Fig. 9-14—Diagram of the 6-meter b.c.-band halo.

of the halo and the shield of the coaxial cables a shown in Fig. 9-14. With this arrangement, I am able to receive signals on the b.c. band and still use the antenna for 6-meter operation.

— Barrie C. Hiern, K5SGP

CAR BATTERY REMINDERS

ALWAYS keep battery terminals clean and tight, because corrosion reduces the charging current supplied to the battery by the charging system.

Periodically check system voltage with a voltmeter to make sure the generator is developing sufficient voltage. Look for excessive voltage drops caused by loose or high-resistance cables.

Check specific gravity with a hydrometer once a month and recharge the battery if necessary. Add distilled water to the battery as required.

Check regulator setting after regulator has come up to operating temperature. Too high a setting of the voltage regulator is damaging to the radio, light bulbs, and ignition contacts. Too low a setting will allow the battery to become discharged.

INCREASING VIBRATOR LIFE IN THE ELMAC POWER SUPPLY

USERS of the Elmac M-1470 power supply may have noticed excessive sparking in the vibrator. This may be eliminated with a resulting increase in vibrator life by simply changing the buffer capacitors C_{16} and C_{18} from their original value of 0.1 μf. to 0.5 μf. These capacitors should have a 600-volt rating.

— Harry Stewart, W8PSV

MODIFYING COMMAND TRANSMITTER RELAYS FOR 6-VOLT OPERATION

WHEN modifying Command transmitters, many hams discarded the seemingly useless antenna relay — the one with two coils and no standard contacts. Fortunately, I saved mine and have since found a good use for the units.

The keying relay for the transmitter is ideally suited for mobile gear because of its compact size and pair of s.p.s.t. contacts, but it won't operate on 6 volts. However, the 300-ohm coil for this relay can be easily replaced with one of the 90-ohm coils from the antenna relay. To complete the transfer, it is necessary to reduce slightly the length of the core for the 90-ohm winding, and this job can be quickly done with a hack saw and file. Removal and relocation of the coils is a simple task because each is held in place with a single flat-head screw.

The modified relay (Fig. 9-15B) really works on 6 volts and draws only 70 ma. or so from the battery. And the compactness involved is enough to catch the eyes of any mobile fan.

— K. M. Isbell, W6BOQ

POWER-CONTROL KINK FOR MOBILE OPERATION

IN mobile installations using a dynamotor plate supply, the *carry-over* voltage that lasts for a short interval after the dynamotor primary power has been turned off will frequently prevent real rapid break-in operation. This can easily be prevented in installations that employ a d.p.d.t. relay for antenna and plate-supply control by wiring the relay circuit as shown in Fig. 9-16. In this arrangement, R_1 (approximately 100 ohms) is

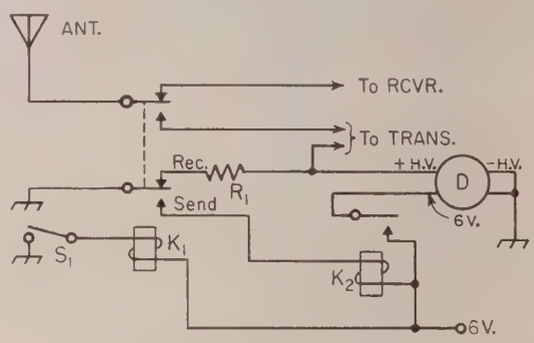

Fig. 9-16—A transmit-receive hook-up that prevents hold-over of the dynamotor output voltage. K_1 and K_2 are the antenna changeover and dynamotor starting relays, respectively. R_1 is the dynamotor grounding resistor (see text) and S_1 is the push-to-talk switch.

connected between the output terminal of the dynamotor and ground whenever the relay is tripped to the *receive* position. This action bleeds the supply output to ground almost immediately.

— Fred Nazar, W8RNA

HINT CONCERNING THE KWM-1

USERS of the KWM-1 may sometimes have some difficulty when tuning the receiver due to an apparent electrical instability in the tuning mechanism. The trouble usually shows up as an intermittent bubbling sound and requires a rapid back-and-forth movement of the kilocycles control to reduce the trouble.

A small spring contact makes a mechanical connection between the kilocycles control tuning shaft and ground. When this contact becomes dirty or corroded, the above tuning difficulty becomes apparent and seems to be more prevalent when the KWM-1 is used mobile. It is only necessary to clean the contact to cure the trouble. Apply some contact cleaner and lubricant solution such as the General-Cement DE-OX-ID on the connection with an eye dropper or hypodermic needle injector. *— John Hunt, WØYBE*

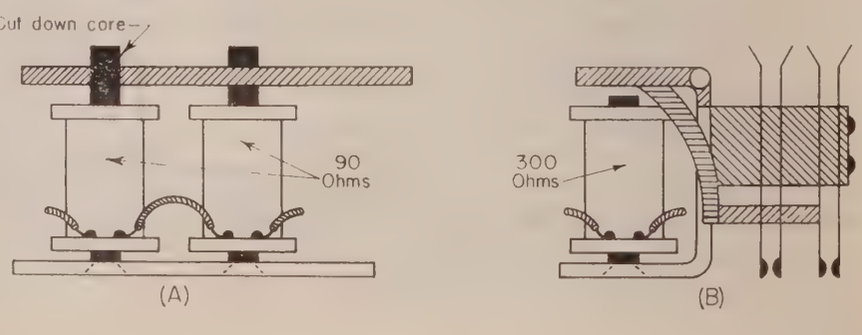

Fig. 9-15—Drawings of the Command transmitter relays. The 300-ohm winding of B is replaced with a 90-ohm coil from A in the modification suggested by W6BOQ.

TUBELESS CONVERSION FOR 75-METER MOBILE

THOSE WHO have recently acquired a car with 12-volt system may be somewhat staggered at the prospect of acquiring, or modifying, both a receiver and transmitter for 12-volt operation. The following temporary expedient takes care of the receiver and allows one to concentrate his energy and finances on the rig.

Most of the modern auto receivers use an i.f. of 262.5 kc. With the receiver tuned from approximately 1356 to 1606 kc., the second harmonic of the mixer-oscillator beats with 3.5- to 4.0-Mc. signals to provide a 262.5 kc. i.f. All that is needed, then, is an input circuit to match the low impedance of the 75-meter mobile antenna. In the interest of simplicity, it is possible to bypass the r.f. amplifier and to use a fixed tuned, broadly resonant circuit. Sensitivity, as provided by this system, is adequate, and while the selectivity is not all that might be desired, it is not as poor as might be expected.

Parts required are a 100K resistor, a d.p.d.t. wafer switch, and a small coil of approximately 40 microhenries, as shown in Fig. 9-17. The coil

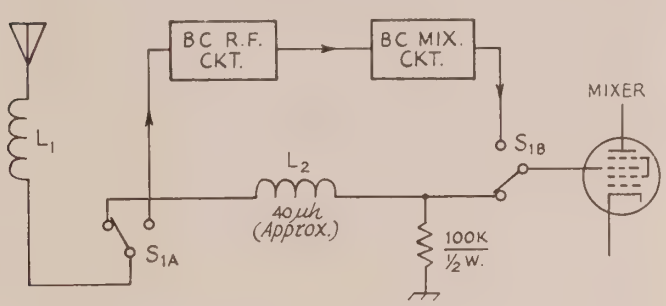

Fig. 9-17—Input circuit for the tubeless 75-meter conversion system suggested by K6YRQ. L_1 is the whip antenna loading coil and S_1 is a d.p.d.t. selector switch. L_2 may be slug tuned, or it may be approximately 85 turns of No. 32 enameled wire close-wound to a length of ¾ inch on a ½-inch diameter form.

should be self-resonant somewhere near 4.5 Mc., as determined with a grid-dip meter. The antenna input terminal of the receiver is fed in series with the coil to the mixer grid, with the 100K resistor for grid leak. This, in effect, forms a pi net, with the input capacity of the mixer tube on the high impedance end, and the capacitance of the coaxial cable from antenna on the low impedance side.

Although many refinements are possible, the system described performs surprisingly well without involving complication or expense.

— *W. S. Skeen, W7EPM*

—···—

THANKS to Don Middleton, WØNIT, for reporting his "150 stations worked" while using a tubeless conversion system. Don coupled his 75-meter mobile antenna *directly* to the *front end* of a Motorola type 75MF (Ford No. FEG 18806-H) receiver. This particular set uses tubes designed to operate with plate and screen voltage supplied directly from a 12-volt storage battery and a transistorized audio section. Tubeless conversion should be of particular interest to amateurs owning this general type of receiver because the sets have no high-voltage plate supply which may be used to power a standard converter.

WØNIT, working along with WØANO and WØCYK, has found out a few other things about tubeless conversion. First, the 75-meter signals may show up at four or five spots on the broadcast receiver dial because of the relationship between the harmonics of the receiver oscillator and the signal frequency. Tuning at the high-frequency end of the dial gives the most band spread.

Secondly, a low-*Q* parallel-tuned trap, tuned to approximately 1560 kc. and connected in series with the antenna lead (inside the receiver), will suppress broadcast signals that otherwise feed through in the 1506.25 to 1606.25 range — the receiver range used to tune the 75-meter signals.

And last but not least is the desirability of using a whip antenna that has been resonated right on frequency. Performance of the tubeless conversion arrangement falls off considerably when the antenna loading coil is only a turn or two off resonance. — *Ed.*

FORMED PLASTIC WASHERS FOR MOUNTING MOBILE ANTENNAS

IT is sometimes desirable to mount a mobile antenna on the fender or rear deck of a car where the body is not flat. Each such installation presents a problem of obtaining specially shaped washers to go between the car body and the antenna mounting surfaces which are always flat. The following method will provide a close-fitting and professional-looking job.

Two thermoplastic (Plexiglas or Lucite) washers about a quarter inch thick and the same diameter as the antenna base are first roughed out with a hack or jig saw. They must then be trued up in a lathe so that the outside rim and the hole are round and concentric. The plastic washers are then placed in a pan of boiling water for a few minutes until they are soft enough to bend. One of the washers is then fished out of the water and immediately placed on the exact spot where the antenna is to be mounted and bent to fit the curvature of the car body at that point. The plastic ring can be handled either by wearing gloves or simply holding it with a dry rag. In a few minutes the washer will cool and set to the shape of the car body. If the underside is the same shape as the top surface, both washers may be shaped from the outside, which is easier.

The washers are then centered in a three- or four-jaw lathe chuck. They are easily centered by trial and error as extreme accuracy is not required here. The convex face of one washer is then turned flat and the concave face of the other one is made flat.

These two washers will now fit against the car body, one inside and one outside, with both external surfaces flat and parallel. The antenna can be mounted on them with a neat fit that would be very difficult to obtain any other way.

— *C. A. Thunen, W6ACT*

MOBILE ANTENNA MOUNTS FOR 144 MC.

THE antenna mounting bracket shown in Fig. 9-18 is made from a piece of 0.064-inch aluminum strip. It permits vertical mounting of a quarter-wave 144-Mc. whip and can be easily fastened to the rain trough, above a car door, by self-tapping screws.

The ⅞-inch mounting hole at the top of the bracket will accommodate the base of a Master Mobile 2-meter whip. On the other hand, the bracket may be fitted with a Type 83-1J coax

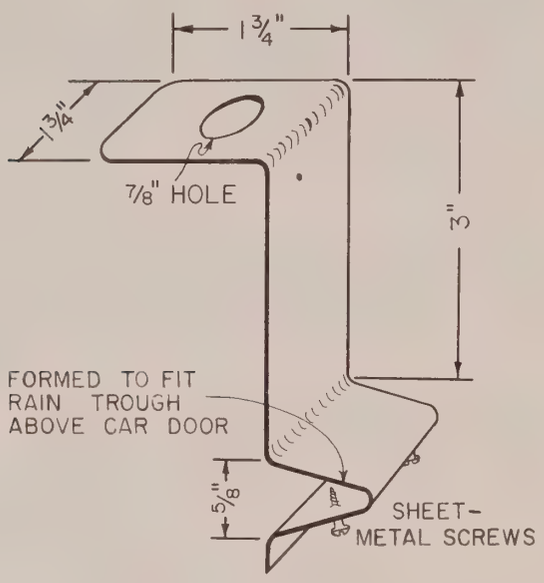

Fig. 9-18—This simple homemade bracket mounts on the rain trough of a car and supports a 144-Mc. vertical whip.

adapter so that a homemade whip, based with a Type 83-1SP connector, can be quickly fastened to the assembly.

Fig. 9-19 shows a more complex but more efficient antenna mount. The base for the assembly, a rubber suction cup such as is used with car-top carriers, is fitted with a brass adapter (homemade) that mates with a Type 83-1T coax "Tee" adapter. The suction cup and the brass insert are fastened together with a flat-head machine screw.

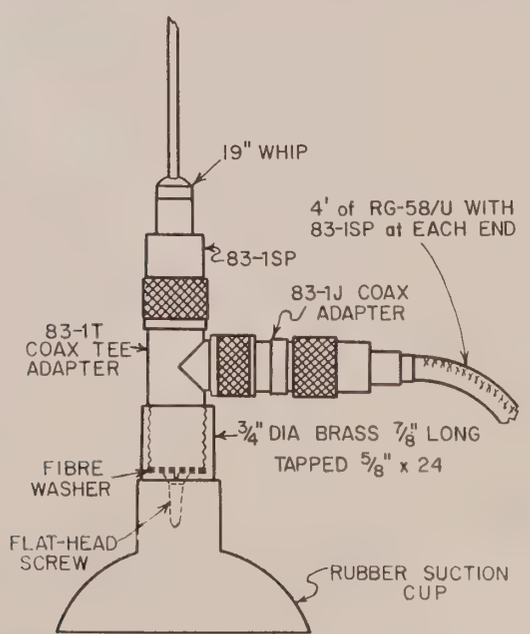

Fig. 9-19—A simple but efficient method of mounting a 144-Mc. whip at the center of a car roof.

The head of the screw is covered with a fiber washer to prevent contact between the screw and the inner conductor of the Tee adapter. If the inner conductor of the Tee is drilled out at the bottom end, it will not be necessary to use the fiber washer.

R.f. power is fed to the center tap of the Tee adapter via a length of RG-58/U cable, a Type 83-1P plug and a Type 83-1J "straight" adapter. The 19-inch whip, equipped with a 83-1SP connector, mates with the top end of the Tee adapter.

Both of the installations are neat in appearance, can be easily mounted on the car, and permit rapid removal of the antenna. When mounting the system shown in Fig. 9-19, it is advisable to apply a thin film of glycerine to the inside of the cup before the latter is fastened to the roof of the car.

Incidentally, a gain in signal strength is evident when changing over from the rain trough to the roof-center mounted antenna.

— Gerald Bagdy, K5KHP

SIMPLIFYING THE "HIDDEN GEM"

THE "hidden gem" described in *QST* for March, 1955, is one of those simple but valuable gadgets that will interest all mobileers. Perhaps some of the gang will be interested in a simplified version that I used while touring.

My installation consisted of a 0–1 milliammeter, a crystal diode, a pair of shielded leads and a small r.f. pick-up coil. The meter was mounted on the side of the converter by means of angle brackets and the crystal was supported by a meter terminal. The shielded wires traveled via an out-of-sight route to the trunk of the car and there terminated at a pick-up coil. Fig. 9-20 is a circuit diagram of the set-up.

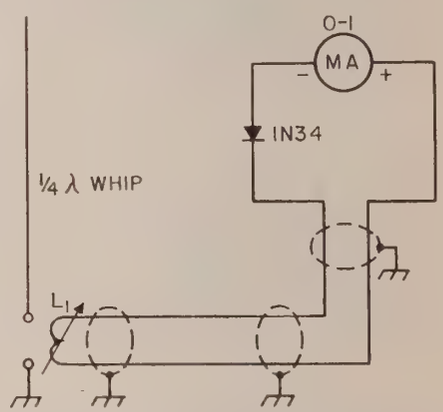

Fig. 9-20—Circuit diagram of the simple field-strength meter used by VE7ASL.

The r.f. pick-up coil, L_1 of Fig. 9-20, should be made with a few turns of stiff wire so that it will be self-supporting. The amount of r.f. picked up by the coil may be adjusted by altering the proximity of the coil with relation to the base of the whip, or by spreading the turns physically. In any event, the adjustment should be one providing about ½-scale reading on the meter when the carrier is unmodulated. A ½-scale reading without modulation allows the meter to deflect still further without pinning when modulation is applied.

— Chas. H. Freeman, VE7ASL

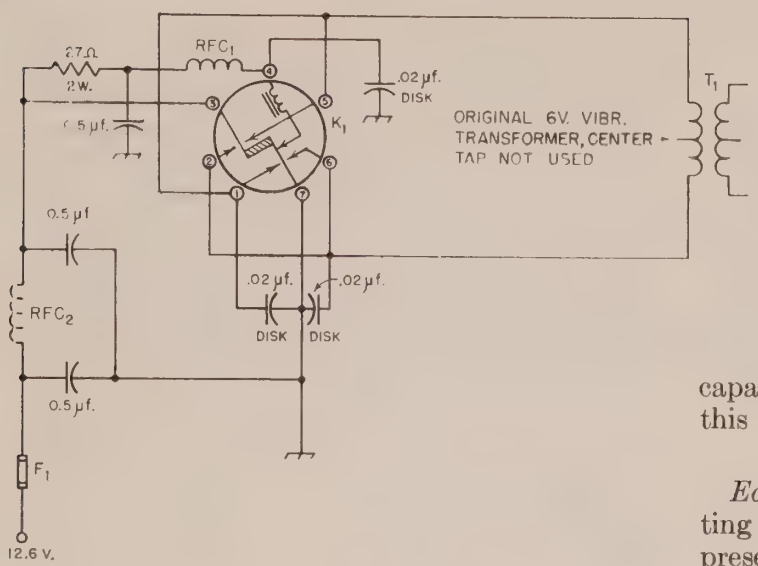

Fig. 9-21—Diagram of a split-reed vibrator as connected into the primary circuit of a 6-volt vibrator supply.

F_1—Fuse rated to suit current drain.
K_1—Split reed ribrator; see text.
RFC_1—7-μh. r.f. choke (Ohmite Z-50).
RFC_2—Approximately 14 μh.: 55 turns No. 12 wire, close-wound on 1-inch diam. form. (Mallory type RF583 has higher inductance and may therefore be more effective.)

USING 6-VOLT VIBRATOR TRANSFORMERS WITH 12-VOLT AUTOMOTIVE SYSTEMS

NOW THAT the 12-volt automotive electrical system has become almost standard equipment, many 6-volt vibrator transformers have become surplus. The following describes a means of using these transformers with 12-volt installations.

It should be understood that the 6-volt transformer has a primary that is actually a 12-volt center-tapped winding. Normally, 6 volts is connected to the tap and the outside ends of the winding are grounded alternately (by the vibrator) to excite first one half and then the opposite half with a pulse of 6 volts d.c. Now, if 12 volts is connected across the entire winding (no connection to the center tap) and the polarity reversed every half cycle, we have essentially the same thing as before. This method of operating the transformer is made possible by the use of the recently designed split-reed vibrator.

The split-reed vibrator is a nonsynchronous type and has a 6-volt driving coil so that universal 6/12-volt units can be built using the same transformer. A series resistor can be used to drop the battery voltage or the coil can be placed in the series-parallel filament ladder so as to provide the required 6 volts. In the average ham installation, the use of a series dropping resistor seems to be the practical solution and a value of 27 ohms (2 watts) will be about the correct value. Fig. 9-21 is the diagram of the primary circuit of a supply using one of the split-reed vibrators. Notice that the vibrator has a 7-pin base. As a result, it probably will be necessary to substitute a 7-prong socket for the one already in the supply. Mallory, Cornell-Dubilier and Oak are some of the concerns that manufacture vibrators that will work in the circuit. The one used in this particular instance is the Oak type V6853. This unit has a reed frequency of 100 cycles and is rated for a maximum current of 8 amperes.

The only apparent disadvantage seems to be that this circuit requires more hash suppression than does the conventional type. However, a good ground for the metal vibrator case and some experimentation with the values of bypass capacitance at the vibrator socket will make this circuit as quiet as any.

— Laurence B. David, W4YEJ/W4WIS

Editor's Note: Thanks to K4HEZ for submitting vibrator information quite similar to that presented above. K4HEZ also reminds us (1) that a tube or a metallic rectifier must be added during the installation of a split-reed vibrator if the supply undergoing modification is of the synchronous type, (2) that the Motorola type 48C830082 vibrator is well suited to the job.

USING FILM REELS AS CAPACITIVE HATS

HAVE YOU ever tried using a 16-mm. movie film reel as the capacitive hat for a mobile whip? These reels are readily modified for simple mounting, and perform effectively as capacitive loading units. You may even be lucky enough to obtain one or more slightly damaged reels at no cost by visiting a film library or concern that rents home-entertainment films.

In the original form, a reel consists of two round disks joined at the centers by the hub on which the film is wound. Only one of the disks is used for capacitive loading purposes and, as a result, the reel should be split into two sections by removing the hub. Enlarge the hole at the center of one of the disks to accommodate a bushing or other suitable hardware, slip the assembly down over the top section of the whip, and you are in business.

This idea was actually suggested by W5YZL. It has worked out so well in practice that I thought it worth passing along.

— E. V. Blaize, jr., W5TVW

[EDITOR'S NOTE: See "Top Loading Capacitance," *The Radio Amateur's Handbook*, Chapter 19, for additional data on capacitive hats and the effects of capacitive loading on loading coil inductance.]

TUNING THE HELIWHIP TO FREQUENCY

MANY of us would like to tune the "Heliwhips" to frequency but don't like the idea of unwinding turns to raise the frequency of resonance. Tuning can be done very easily by winding a sleeve of aluminum foil so that it covers a few turns at the bottom of the tightly wound portion of the whip. After the correct number of turns have been covered, wind plastic tape over the foil for protection.

If the desired frequency is lower than the natural resonant frequency, tape containing ferrous material, such as audio recording tape, might be tried. *— Milford W. Noe, W6IMW*

IMPROVED PUSH-TO-TALK CIRCUIT FOR MOBILE OPERATION

MANY mobile operators who parallel the receiver-disabling and antenna relays with the push-to-talk control experience trouble with momentary receiver overload each time the transmitter is turned off. This is caused by dynamotor "coasting" which keeps the transmitter energized for a brief period after the receiver has been activated. Although the problem can be licked by using the system described by W8RNA on page 102, there is a somewhat simpler solution that requires no *bleeding* of the dynamotor.

The control circuit used here at W3HXY has the antenna and receiver changeover relays connected in parallel with the *input* terminals of the dynamotor. After the push-to-talk control has removed input voltage from the dynamotor, the "coasting" action causes the generation of approximately 6 volts (12 volts with a 12-volt system) across the input terminals. By wiring the relays — antenna and receiver — directly across the input terminals, the relays remain energized until the dynamotor has coasted to nearly a full stop. Thus, the receiver does not come *alive* until after the transmitter signal has *died* away.

— *Roy W. Shetter, W3HXY*

PUSH-TO-TALK CONTROL OF MOBILE CHARGING RATE

MANY OF THE newer automobiles with automatic transmissions have, coupled to the shift lever, a pair of contacts which prevent operation of the starter solenoid whenever the transmission is in the "drive," "low," or "reverse" condition, but which close when the shift lever is placed in the "park" or "neutral" position. It is convenient to wire a d.c.-operated solenoid through this safety contact and the transmitter push-to-talk relay contacts, with the solenoid arranged to open the throttle lever on the carburator slightly when energized. When parked, this has the effect of allowing the engine to idle normally during the receive condition, and increasing engine speed for charging purposes by any desired amount while the transmitter is on the air, offering an improvement in the automotive system voltage regulation and reducing noise (both electrical and acoustic) over that which would exist if the engine were operated with an open throttle during both transmitting *and* receiving periods. When the car is in motion, the safety contacts on the shift lever disable this control system to prevent interference with the driver's control of engine speed.

— *Richard A. Schomburg, W7WUM*

MORE ABOUT GENERATOR NOISE

WORN and otherwise defective generator bearings have been identified as a source of electrical interference. In a mobile installation here, the receiver was bothered by a raspy type of noise that sounded similar to power-line leakage. It was present on all bands and, at times, seemed to build up and discharge with a sawtooth characteristic. Breaking the field and the armature connections to the generator did not appear to affect the intensity of the noise. However, the replacement of a worn bearing did completely eliminate the interference. A probable explanation is that the generation of static electricity was greatly reduced by the repair.

— *Joseph E. Stuckey, W4HCV*

10. Hints and Kinks . . .

for Test Equipment

IMPROVED R.F. SAMPLER

HERE is an idea that should be of interest to hams who have oscilloscopes and are puzzled about a convenient way to sample the r.f. output of their transmitters for checking modulation or keying characteristics.

The *Handbook* indicates that the r.f. sample may be secured by a pickup coil in the field of the amplifier tank. This is not the most convenient setup, especially for those who have completely shielded transmitters with coax output.

It has been found that five turns of No. 3014 B & W Miniductor can be placed in series with the coax transmission line without materially changing impedance characteristics. Around the Miniductor is a 5-turn link made from the end of a length of small coax. The coil and link are in a $4 \times 2\frac{1}{4} \times 2\frac{1}{4}$-inch Minibox with coax fittings. The link coax leaves the box via a grommet.

Shown in Fig. 10-1 is the resonant circuit, a multiband tank circuit in a separate Minibox. Each of the two tank coils is associated with a 4-turn link. The vertical plates of the scope are connected to the multiband tank. The scope is not grounded.

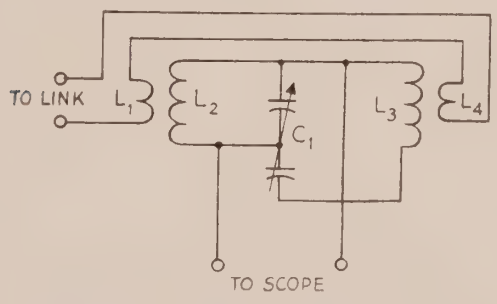

Fig. 10-1—Multiband circuit used with an oscilloscope to observe r.f. wave forms.

C_1—Midget dual variable capacitor 140-$\mu\mu$f.-per-section.
L_1, L_4—4 turns each wound in series over L_2, L_3.
L_2—22 turns No. 18 enam., 1-inch diam., close-wound.
L_3—8 turns No. 18 enam., 1-inch diam., 1 inch long.

Adequate display heights are secured at resonance with power as low as 50 watts and for higher power the tank capacitor can be detuned as necessary.

The Minibox that houses the tank circuit also houses the potentiometer, resistors and capacitor associated with the usual circuit for securing a trapezoid modulation pattern. Thus the setup is convenient for observing modulation patterns and keying characteristics at any time.

Incidentally, connection of r.f. directly to the vertical plates is not recommended for some of the low-priced kit scopes. With these scopes, feed the plates through .005 ceramic capacitors, and connect the plates to the scope circuit through 1-megohm resistors. This can be done at the rear of the scope with a mounted lucite strip, six binding posts and two jumpers.

— *Cecil W. Guyatt, K3ABN*

LINK-COUPLING TO THE GRID-DIP METER

ALTHOUGH this idea may be "old stuff" to many, it was a new and handy stunt here.

In putting some new coils in a bandswitching transmitter, it was found desirable to check their frequency coverage. Unfortunately, there was no way to get at the coils with the meter without disassembling the rig. The solution was link-coupling. I made a flexible link out of a piece of 300-ohm Twin-Lead about 15 inches long with a single-turn loop at each end. The exploring end has a loop about two inches in diameter and the other end has one just big enough to slip over the coil of the grid-dipper. By opening up a small crack in the shielding, it was possible to maneuver the inner end of the link into position against the coil to be measured and the meter then performed just as well as though it were coupled in the usual manner.

Twin-Lead is ideal for this purpose as it is stiff enough to be manipulated readily from the outside but can be bent at any angle necessary to reach the most difficult location. On the lower frequencies, two or more turns at each end of the link may be needed to provide sufficient coupling.

— *Cyrus T. Read, W9AA*

THE GRID-DIP METER AS AN AID TO CRYSTAL GRINDING

Recently, while grinding some war-surplus crystals into the 7-Mc. band, it became obvious that most of the elapsed time had been spent mounting and unmounting the crystals so that activity and frequency checks could be made. In an attempt to do away with as much of this extra work as possible, we devised a practical and time-saving method that involves the use of a grid-dip meter.

When using the grid-dip meter, it is first necessary to unmount the crystal from its holder and then insert it into the coil covering the frequency range under consideration. The grid-dip meter is then tuned for a dip at the crystal frequency and the amount of dip is noted as a criterion for checking crystal activity during the grinding process. The initial steps being concluded, brawn, elbow grease, grinding compound and the other necessary ingredients are brought into play for the actual grinding. Whenever enough grinding has been done to warrant a frequency and activity check it is only necessary to wipe off the crystal, then insert it into the grid-dip meter coil. Depending on which side the crystal frequency is approached from, the meter may either dip gradually or suddenly as the frequency is approached. Most crystals will exhibit a gradual dip from the high-frequency side of resonance. The frequency of maximum dip is the crystal frequency and the amount of dip as compared with the initial standard earlier established determines the relative activity of the crystal. In either case use standard crystal-grinding technique to approach the desired frequency or to improve crystal activity. Most grid-dip meters are not sufficiently well-calibrated for precision accuracy but once the desired frequency is approached more accurate measurements can be made by checking the meter against a communications receiver. In following this practice, the meter is again tuned for maximum dip, the calibrated receiver is tuned to zero beat with the meter and the frequency read directly from the receiver dial.

Conversely, the calibration of a grid-dip meter can be checked with crystals of known frequencies. It is only necessary to insert an unmounted crystal of known frequency within the inductive field of the appropriate coil. Maximum dip of the meter indicates resonance with the crystal. The ham who possesses a number of surplus crystals with odd frequencies which cannot normally be applied to amateur radio practices can make good use of these crystals by mounting them permanently, minus holders, in the appropriate grid-dip meter coils. Two crystals mounted within one coil, with frequencies near the lower and upper limits of the range under consideration, or in close proximity to the most used frequencies, afford a number of check points for determining meter accuracy. If, for instance, we are measuring the resonant frequency of a coil, unless the coil is kept a sufficient distance from the grid-dip meter, it may alter the meter calibration. In such a case, the accuracy of the instrument can rapidly be checked against the crystal and if the calibration has been altered, the amount of deviation can be determined from the crystal check and applied toward the actual measurements being made.

The quartz crystal being of a nonconducting substance will, of itself, have no effect on the calibration of a coil within which it is mounted. Care should be used in determining which is the crystal dip and which is the resonant circuit dip in cases where a circuit whose frequency approaches that of the crystal is being measured. In cases where the circuit under consideration is of the same frequency as the crystal, resonance will be indicated by a further dip of the meter.

Depending on the relative sensitivity of the grid-dip meter being used, the crystal can be placed on either the outside or the inside of the coil. Maximum meter reaction will be had by using the outside method of mounting, while the inside method is more suited for a permanent job. The crystal, minus holder, is attached to the coil with a small amount of Duco or similar cement. The crystal frequency as noted from the holder is marked on the grid-dip meter coil. It may be advisable to adjust the crystal into a position giving the amount of dip desired prior to applying the cement. — *Alvar J. Kent, W1KJO*

USING A TV RECEIVER TO CHECK GRIP-DIP METER CALIBRATION

I recently completed a kit-type grid-dip oscillator and wanted to check oscillations at the high-frequency end. The unit was designed to oscillate up to 250 Mc.

It occurred to me that the home TV set might be used to check frequencies up to 216 Mc. (Channel 13). So I turned on the grid-dip unit and the TV set. The grid-dipper was rested on top of the TV set and Channels 2 through 13 were turned on in succession. For each channel the grid-dip frequency dial was appropriately set, using the correct plug-in inductance.

It was observed that both sound and picture were distorted when the grid-dipper was tuned through the appropriate range of frequencies for each channel. It is not necessary for a station to be operating in order to perform a quick check on any channel. As long as any kind of raster can be seen, the disturbance caused by the grid-dip oscillator will be readily seen.

This simple test actually serves two purposes: first, it shows the presence of oscillation from about 50 to 216 Mc. Second, it indicates the accuracy of dial calibrations of the instrument tested.

This same method can be used to check other types of oscillators operating in to 50- to 216-Mc. range.

— *Paul Goldman, K2GKU*

[Editor's Note: Frequencies of oscillation below 50 Mc. can probably be checked quite accurately by the above method as long as the oscillator output contains harmonics falling in the TV range. The BCI and TV chapter of *The Radio Amateur's Handbook* lists the frequencies of TV Channels 2 through 13 and explains how the frequencies of the picture and the sound carriers may be determined.]

R.F. ISOLATOR FOR D.C. METERS

Occasionally, fellow amateurs have come to me with d.c. meters that were in need of repair. It appeared that many of these meters were damaged by large overdoses of r.f. The owners reported that the readings weren't always consistent even when the meters were working. The reason for this inconsistency was probably the same — r.f. getting into the instrument.

The device shown in Fig. 10-2 will enable the user to measure safely d.c. voltages in circuits where r.f. voltages are present. It will also minimize the loading effect on the circuit by the meter.

The isolator consists of a series isolating resistance built into a probe and bypassed for r.f. When the probe is used with a sensitive d.c. current meter the series resistance can be calculated by using the following formula:

$$\textit{Resistance}\ (\text{megohms}) = \frac{\textit{full scale voltage desired}}{\textit{full scale current value of the meter}\ (\text{in}\ \mu\text{a.})}$$

Use two or three resistors in series to make up the total resistance; this will provide a longer r.f. leakage path. For good r.f. isolation, ranges which require a series resistance of less than one megohm should be avoided. If a v.o.m. is used, it is easier to choose a scale that is already calibrated so that the voltage may be read directly from the old scale. I use the 0- to 60-μa. range on my v.o.m. so that a 2-megohm resistor gives a 0- to 120-volt d.c. range.

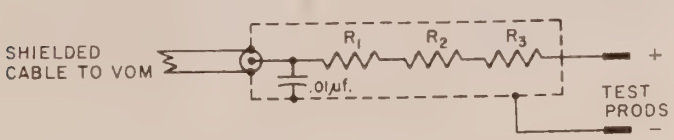

Fig. 10-2—Diagram of the r.f. isolator. Resistors R_1, R_2 and R_3 should total the value found by the formula in the text.

— *Stuart E. Bonney, W8JUV*

IMPROVISED R.F. SNIFFER

Conventional vacuum tube voltmeters can be used for antenna coupling and tuning adjustments simply by switching to the a.c. voltage range and plugging a loop of wire into the a.c. input jacks. The loop acts as an r.f. pick-up and the induced r.f. is rectified by the diode in the a.c. circuit. — *Frank D. Witmer*

AUDIO FREQUENCY TEST SIGNAL WITHOUT AN AUDIO OSCILLATOR

If an audio generator is not available when next needed, or should the one on hand deliver inadequate or badly distorted output, try the system used here at W2ZZG.

A good sine wave, as indicated by an oscilloscope, is obtained by feeding the v.f.o. signal into a communications receiver operated with the b.f.o. turned on. Audio output for test purposes is taken from the last stage of the receiver, and the amplitude of the signal is regulated by the audio gain control. Signal frequency is varied by regulating the b.f.o. control.

Naturally, the stability of the v.f.o. and the receiver play an important part in determining the stability of the audio test signal. Furthermore, coupling between v.f.o. and receiver should be tight enough to mask out any noise that leaks into the front end of the receiver, but not so tight as to overload its r.f. amplifier. By experimenting with the input coupling, and by keeping the r.f. gain *down* in the interest of linearity, it is usually possible to end up with an audio output signal that looks quite good on the face of a scope.

Although the equipment used here is not calibrated in terms of audio frequency, the frequency of the test signal can be intelligently estimated. In any event, the signal obtained is a lot more favorable for many jobs than is the frequently interrupted WWV signal used by some as a source of audio. — *Arthur H. Pedley, W2ZZG*

A BAND-EDGE MARKER

A fool-proof band-edge marker can be made very simply by using quartz crystals and a neon bulb. When the v.f.o. tunes across the frequency of either crystal, the neon bulb will flash, indicating the edge of the band. Crystal Y_1, can be chosen for the low edge and Y_2, for the high edge of the band. However, it is well to remember that if too many crystals are connected in parallel the holder capacity will pass a signal of any frequency.

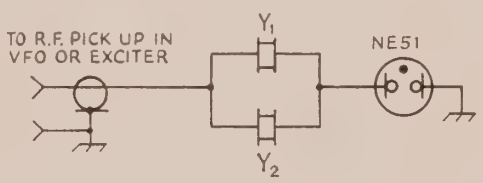

Fig. 10-3—Diagram of the band-edge marker.

The pick-up for the radio frequency voltage can be a short piece of wire placed near a hot tank circuit in the v.f.o. or exciter. Of course, the r.f. field must be strong enough to provide sufficient voltage at the terminals of the neon bulb to light it.

— *John Grindon, WØUVX/9*

SHIELDING DUMMY LOADS

While checking a new rig I connected a dummy load (a 25-watt lamp) to the transmitter. During the checks I heard an out-of-town station calling CQ. I was still using the dummy antenna on the transmitter but since I was tuned up on his frequency I gave him a call just for fun. Not only did I make the contact but I also received a good report!

A later check with a field-strength meter indicated an extremely strong r.f. field around the lamp. I applied several coats of conductive paint (Television Tube Coat, General Cement No. 49–2) to the glass envelope around the lamp, leaving a small ¼-inch circle to allow observation of lamp brilliance. After this coating, the field-strength meter gave only a slight reading a few inches from the dummy load. Now, the lamp makes a good dummy antenna.

— *Harrison A. G. Stone, K2LIF*

TUNED R.F. PICK-UP CIRCUIT FOR OSCILLOSCOPES

THIS is an idea that should interest those who use an oscilloscope for making modulation checks. The stunt is that of using a simple multiband tuner as the r.f. pickup for the scope. Use of the system requires no *direct* connection to the audio or r.f. stages of the transmitter undergoing test, and provides ready adjustment of the input to the oscilloscope to compensate for changes caused by band changing, power input differences, etc.

A short r.f. probe or antenna is used with the multiband tank as shown in Fig. 10-4. This probe or antenna may have to be inserted an inch or two into the transmitter housing if the power is low and the rig well shielded. Output from the tuner is connected directly to the vertical plates

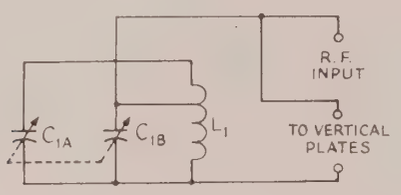

Fig. 10-4—Circuit used by W7KLE for feeding r.f. to the vertical plates of an oscilloscope.

C_1—Receiving-type dual variable, 140-$\mu\mu$f. per section.
L_1—Approximately 13.5 μh.: 25 turns No. 20 tinned, 1⅜-inch diam., 1⅜6 inches long, tapped at 9 turns from end connected to C_{1A}.

of the scope. *Warning — High Voltage* is applied to the vertical plates, so make the connections with the scope turned *off*.

The tuner was made from junk-box parts and covers all frequencies in the 3.5- through 28-Mc. range. When using the circuit, the height of the r.f. envelope on the scope tube may be controlled by adjustment of the position or the length of the pickup antenna, or by tuning C_1 either to exact frequency or slightly off resonance.

As is the case with other multiband tanks, this one will tune 3.5 and 14 Mc. with C_1 set well toward maximum capacitance. Resonance at 7 and 28 Mc. will occur with C_1 adjusted toward minimum capacitance, and 21 Mc. will show up with about one third of the total capacitance in use. — *Floyd X. Passmore, W7KLE*

PROTECTION FOR VOLT-OHM-MILLIAMMETERS

MANY of us who make frequent use of a general-purpose test meter will, at one time or another, inadvertently apply voltage to the terminals of an instrument having the function or selector switch set at the *ohms* position. This act of negligence may result in a burnt-out multiplier shunt, a new configuration for the pointer or even more serious damage to the meter movement.

The installation of a fuse as a preventive measure against this mistreatment of a meter is not always desirable or completely effective. The resistance of low-current fuses may not be too uniform and, in some cases, the resistance — whatever it happens to be — is great enough to affect the calibration of the *ohms ranges* of the instrument.

A more positive protection for a meter may be obtained by connecting a No. 14 flashlight lamp in series with the internal shunts. It has been determined that the resistance of these 2.5-volt 0.3-amp. bulbs checks consistently at very close to one ohm. Therefore, once the meter circuit has been modified to include a bulb, it is possible to make replacements in event of failure without concern over variations in calibration.

Fig. 10-5 shows how a No. 14 bulb has been connected into a typical general-purpose test meter.

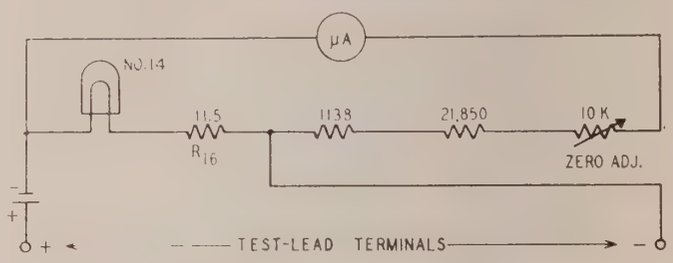

Fig. 10-5—Protective arrangement for volt-ohm-milliammeters suggest by W9AFT.

The circuit and constants shown are for the popular Simpson type 260 meter. The 1-ohm resistance of the bulb is compensated for by removing approximately 2 inches of resistance wire from the 11.5-ohm shunt (R_{16} of the Simpson circuit). Usually, it is possible to find mounting space within the meter case for a socket for the bulb. This method of installation simplifies the changing of a burnt-out lamp.

Any voltage applied to the *ohms* terminals that is lower than the *burn-out* rating of the bulb will not cause damage to the meter shunts. At higher values of voltage, the bulb will burn out even before the pointer can deflect to full scale. It should be pointed out that *all* resistance ranges of a circuit of the type shown are protected by this simple installation.

— *Harlon Wright, W9AFT*

IMPROVED MOUNTING FOR GRID-DIP METER COILS

GRID-DIP meters that use a fiber socket for mounting the plug-in coils frequently perform erratically after prolonged use because of socket failure. One method of making a simple repair is to thread a pair of binding posts into the original socket prongs. The Eby-type bakelite binding post having a 6–32 threaded stud is best for the job. The eye in each post can be enlarged with a drill to accommodate the prongs of the coils.

Usually, it is not necessary to take the meter apart while making the modification. If the coils are more difficult to couple to the new mounting position (they will now protrude out at right angle to the meter case), the condition may be remedied by using link coupling as described by W9AA on page 107.

One thing for sure: The new mount will be more rugged than the original so long as the binding posts are threaded securely in place.

— *Warren Smith, KH6WW*

USING THE HEATHKIT AM-2 REFLECTED POWER METER AS A MODULATION MONITOR

THIS simple modification to the Heathkit Reflected Power Meter makes it possible to use the instrument as a modulation monitor. The only additional part required is a closed-circuit jack. The modification consists of inserting the closed-circuit jack in the lead that comes from the center lug of the potentiometer, as shown in Fig. 10-6. This lead should go to the contact on the

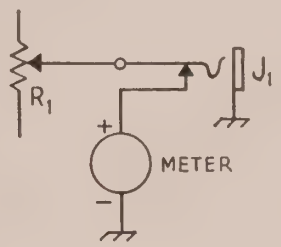

Fig. 10-6—Circuit showing modifications to the power meter. The meter and R_1 are components already existing in the unit. J_1 is a closed-circuit jack.

jack that mates with the tip of the headset plug. The switch terminal of the jack goes to the plus side of the meter. When the headset is removed from the jack, operation of the power meter returns to normal. When the meter is used for a modulation monitor, the potentiometer controls the audio level in the headphones.

— *Emil P. Sulkosky, K1HSR*

V.T.V.M. POWER SUPPLY FOR THE G.D.O.

HERE is a possibility of turning the tables that some amateurs may not have thought of.

Since a vacuum-tube voltmeter can be used as the indicator for a homemade grid-dip meter, it is only logical that the power supply for the v.t.v.m. be used to furnish power for the g.d.o. Seems fair enough doesn't it?

— *Luke McCloud, K2DDM*

ADDITIONAL USES FOR THE S METER

USING the S meter of the station receiver with external leads for certain measurements is not new, but the value of the trick is certainly enhanced when the available meter is of the microampere type. While the fact does not seem to be too widely known, several types of Hammarlund receivers carry a 200-microampere unit, including the HQ-129X, SP-400X and military equivalents. A meter of this rating is ideal for g.d.o., v.t.v.m., f.s. measurements, etc. In the case of the SP series, the meter is rather easily removed and replaced.

— *Otto L. Woolley, WØSGG*

USING B. C. SIGNALS FOR HAMBAND CALIBRATION

AN old-timer passed his idea on to me and possibly it may help some of the other fellows. The stunt is that of using a broadcast-station signal as a frequency standard for making calibration checks in hambands. Here is how the idea is put into practice.

First determine which b.c. stations would have harmonics — if they were not suppressed because of FCC regulations — that fall in the hambands. For example, here in Indianapolis we have the following clmbination to work with:

Station	*Fund. Freq. Kc.*	*Harmonic Kc.*
WLW	700	5th — 3500
WLW	700	10th — 7000
WISH	1310	3rd — 3930
WIRE	1430	5th — 7150

Next, using an r.f. signal generator and a receiver with the b.f.o. turned off, zero beat the generator with the b.c. signal. Leave the generator set as it is and tune the receiver — with the b.f.o. turned on — across the ham-band undergoing calibration. When the harmonic of the generator has been found, turn off the b.f.o. and zero beat the v.f.o. (or other r.f. generating device under test) with the generator harmonic.

Since the b.c. stations operate with a very close frequency tolerance, this method should provide a dependable frequency check.

— *Albert Szalay, W9CKD*

POWER-REDUCTION HINTS FOR S.W.R. BRIDGE MEASUREMENTS

ONE of the problems frequently encountered in making s.w.r. measurements is that of reducing transmitter power output to a level low enough to prevent damage to the bridge. In installations where there is no existing means of controlling output from the amplifier, it is possible to control the power to the bridge by means of the simple system shown in Fig. 10-7. In this arrangement, most of the output from the transmitter is dissipated in the 52-ohm dummy load

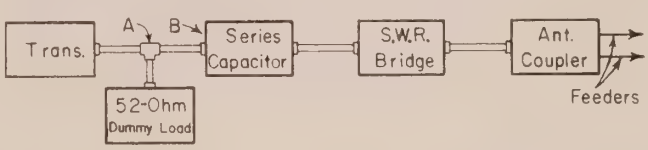

Fig. 10-7—A simple arrangement for reducing power during s.w.r. measurements. A is a "T" coaxial-cable coupler and B is a variable capacitor with a range of approximately 0–100 $\mu\mu$f.

and a portion of the remaining power is fed to the bridge through a variable capacitor.

The dummy load must be capable of dissipating nearly the full output from the transmitter. It should be shielded and equipped for coaxial-cable input. The variable capacitor should also be enclosed in a metal compartment and should be terminated with coax connectors. A standard "T" connector and short lengths of coax may be used for making connection between the transmitter, dummy load and variable capacitor.

When using this method of power reduction, the bridge is inserted in the transmitter output line in the usual manner. Then adjust the variable capacitor for normal reflection of the s.w.r. indicator and proceed as you would with any other set of adjustments or measurements.

— *John W. Stack, W5QQY*

WWV ON THE NATIONAL NC-300 RECEIVER

THE 10-Mc. signal transmitted by WWV may be received on the Type NC-300 receiver as follows:

Clip a 330-$\mu\mu$f. capacitor from the stator of the high-frequency oscillator section of the main tuning gang (front section) to the chassis. Set the antenna trimmer to minimum capacitance and tune across the 40-meter band until the 10-Mc. WWC signal is heard.

This is a somewhat unconventional method of using the receiver, but it provides an economical and simple means of beating a crystal calibrator against WWV for insurance of accuracy.

— *Robert J. Murray, W1FSN*

100-KC. MARKERS FROM A 50-KC. SECONDARY FREQUENCY STANDARD

A SECONDARY frequency standard described in *QST* for July, 1954, duplicated for use here at W5RSH, has been modified so that either 50- or 100-kc. harmonics may be selected. Although the 50-kc. markers are extremely helpful for many types of measurements, there are times when an unknown frequency, or a band edge, can be more quickly identified if the standard frequencies are spaced no less than 100 kc. apart. Unless the 100-kc. points can be definitely established, there is a possibility of a measurement being inaccurate by at least 50 kc. or more.

The circuit of the modified standard is shown in Fig. 10-8. Notice that except for the addition of R_1 and S_1, the circuit is identical to the original. Also observe that the resistor and the switch may be added without requiring any alteration to the basic circuit. The functions of the new components are as follows:

With S_{1A} closed, L_1 is shorted and the circuit takes on the appearance of the more familiar 100-kc. standard. With L_1 shorted, crystals cut for 100, 200 and 1000 kc. will oscillate in the circuit, but the activity of the crystals leaves something to be desired. However, crystal activity can be raised to normal by reducing the value of the cathode bias resistor for the 6AK5. This is easily accomplished by means of R_1 and S_{1B} of Fig. 10-8.

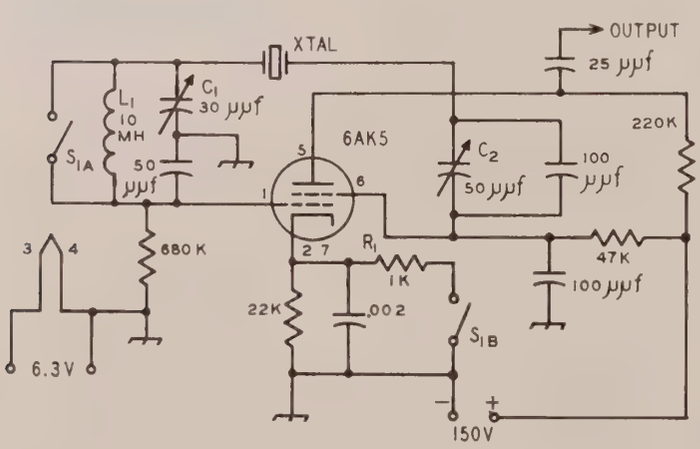

Fig. 10-8—Circuit diagram of the modified 50-kc frequency standard. All resistors ½ watt. All capacitors less than 0.002 μf. are in $\mu\mu$f.

C_1—30-$\mu\mu$f. ceramic trimmer.
C_2—50-$\mu\mu$f. ceramic trimmer.
RFC$_1$—10-mh. r.f. choke (National R-100S).
S_1—D.p.s.t. switch.

If the circuit has been adjusted to zero-beat against WWV for accurate 50-kc. markers, it is probable that the 100-kc. (or higher) harmonics will be slightly *off* frequency when the circuit is switched over. This slight error is of no consequence provided the calibration using 100-kc. markers is rechecked with the aid of the more accurate 50-kc. frequencies.

— *Clark A. Chamberlain, W5RSH*

RECORDING OSCILLOSCOPE TRACES WITH A GREASE PENCIL

THE grease pencil recording technique won't replace the oscilloscope camera, but it does provide a very satisfactory means of making permanent records of many of the waveforms observed on the ham shack oscilloscope. The procedure is to carefully trace out the waveform, marking on the face of the c.r.t. with a grease pencil (China-Marking Lead). Then place a sheet of paper on the face of the c.r.t. and transfer the grease pencil markings to the paper by briskly rubbing over the traced region with your fingernail. The record obtained will be a mirror image. If a real image is desired, use the same technique to transfer the mirror image to a second sheet of paper.

— *Donald F. Hemenway, W3SQP*

INCREASING AUDIO OSCILLATOR RANGE

HERE IS a method for extending the range of an audio oscillator to cover the supersonic range between 20 kc. and 120 kc.

As shown in Fig. 10-9, the crystal rectifier produces a half-wave rectified voltage rich in harmonics. No difficulty has been experienced in generating 100 kc. signals (5th harmonic of 20 kc.) from a Hewlett-Packard 205 type oscillator even at levels far below its 5-watt output rating.

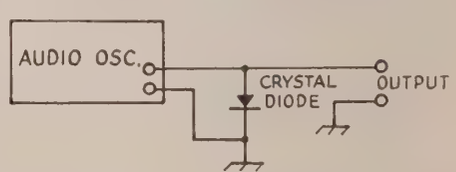

Fig. 10-9—Illustration showing W2LID's method for increasing the range of an audio oscillator.

One of the most useful functions of this arrangement is the provision of a signal source to aid in the alignment of low frequency i.f. amplifiers.

— *D. J. Gagne, W2LID*

BAND-SPOTTER WAVEMETER

A FREQUENT infraction of the rules governing amateur operation is harmonic radiation outside the amateur bands. The device described here is a series of fixed-tuned absorption wavemeters tuned to the various harmonically related amateur bands. With the transmitter operating, the units are advanced toward the transmitter tank circuit (See Fig. 10-10) until one of the indicating lamps begins to light. If more than one lamp lights up, it indicates that harmonic energy is present and should be suppressed.

Fig. 10-10—Band-spotter wavemeter.

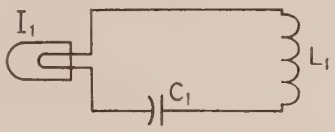

Fig. 10-11—Band-spotter wavemeter. The indicator lamp I_1 is a No. 47 pilot lamp. C_1 is ceramic or mica.

Band	C_1 ($\mu\mu$f.)	L_1	Length
80	100	45 turns No. 28 enam.	5/8 in.
40	47	29½ turns No. 26 enam.	½ in.
20	25	20½ turns No. 24 enam.	½ in.
15	20	18 turns No. 20 enam.	1 1/16 in.
10	10	15 turns No. 22 enam.	½ in.
7.5	10	10 turns No. 22 enam.	½ in.
6	10	9 turns No. 22 enam.	9/16 in.
5	10	6½ turns No. 22 enam.	½ in.
3	5	5½ turns No. 20 enam.	½ in.

Each unit of the wavemeter is built into a plastic tube, such as a pill container, that measures about 9/16 inch o.d. and 2 inches long. A coil is wound on one form and a capacitor is connected as shown in Fig. 10-11. A second plastic case with its bottom cut off to form a tube is held in position while the two leads from the tuned circuit are soldered to the pilot lamp (See Fig. 10-13). Make the leads as short as possible. Cut the plastic cap that comes with the container so that the pilot lamp will make a tight fit when it is inserted in the cap. After the unit has been checked for resonant frequency, the containers are cemented together and the cap containing the lamp is installed. Each of the individual units are then spot-cemented together to form a single multiple unit.

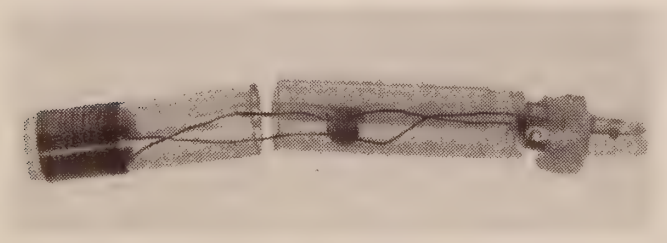

Fig. 10-13—View showing make-up of one of the tuned circuits.

Remember, these units are harmonic band spotters only, and are not to be used as frequency meters. Be careful when using the wavemeter around high-voltage circuits in the transmitter.

— Lee F. Worthington, K4HDX

ANTENNA R.F. INDICATOR

RELATIVE amount of r.f. energy at the antenna can be indicated by a fluorescent lamp taped to the antenna wire at a voltage loop. For a half-wave antenna, this point is at either end of the antenna. Of course, this scheme is only useful to those who can observe the lamp from the shack, although a system of mirrors could be set up for this purpose.

One word of caution: don't be surprised when neighbors report sighting a strange light — the fluorescent lamp can be observed for miles!

— R. H. Sweeny, W1FEQ

INCREASING SENSITIVITY OF NEON BULBS

IN the course of tracking down parasitics in a new rig, I had need for a more sensitive indicator than the usual neon bulb. It was remembered that in some radar units a "keep-alive" voltage was used to keep the gas in the "TR" boxes ionized, and the following scheme was evolved to apply a similar voltage to a neon tube.

A half-megohm potentiometer was used to form a voltage divider by connecting the outside terminals of the potentiometer across the 115-volt a.c. line. Then a small neon bulb (NE-2, ¼-watt, resistorless) was connected between the tap on the potentiometer and one side of the line. Thus, by turning the potentiometer, the voltage across the neon bulb can be varied until it is just *below* the point at which the tube glows. In this condition, very little additional voltage is needed to cause the bulb to glow, and a very sensitive indicator results.

The neon bulb can be mounted at the end of a 4- or 5-inch length of bakelite tubing, which then serves as a probe with which to dig into out-of-the-way places inside your rig. The leads to the bulb can be run inside of the tubing.

In addition to being a simple gadget to construct, this little indicator has the advantage of being very sensitive to r.f. fields, yet it is discriminative enough to enable one to pick out the "hot" lead in a crowded chassis.

— Robert A. Brown, W8COS

FEED-LINE CONTINUITY AND SHORT-CIRCUIT CHECKER

When installing a beam of the split driven-element variety I always connect a 100,000-ohm, ½-watt resistor across the element at the antenna as shown in Fig. 10-14. Installation of this inexpensive component enables me to check continuity or shorts in the feed line at any time by measuring the resistance of the feed line with an ohmmeter. Any value over 100,000 ohms means a break somewhere in the feed line or a bad connection at the driven element. Any value

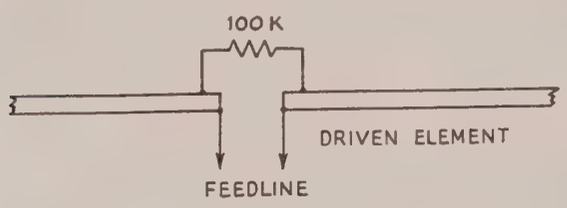

Fig. 10-14—W9DGV's feed-line checker.

less than 100,000 ohms indicates a short. Insertion of the resistor does not affect the performance of the antenna system.

— John E. Greve, W9DGV

MEASURING-CUP BAND SPOTTER

It is not necessary to build or buy an elaborate frequency meter for most amateur purposes, especially when the transmitter is crystal-controlled. Much simpler means can serve the purpose just as well. For example, you could hardly want a simpler circuit than that shown in Fig. 10-15. And as the photographs show, the construction is equally simple. Assembled in a 15-cent measuring cup, this gadget will go a long way toward filling the initial frequency-measuring needs of the Novice licensee. It will also serve the

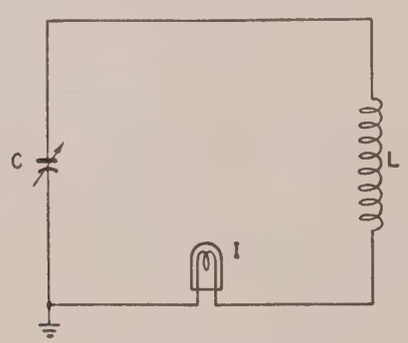

Fig. 10-15—Circuit diagram of an absorption wave-meter covering the 3.4- to 15-Mc. range

C—300-$\mu\mu$fd. variable (National ST-300).
L—22 turns No. 20 wire, 1-inch diam., 1⅜ inches long (B & W Miniductor No. 3015).
—60-ma. dial lamp (pink bead) mounted in bayonet-type bracket (Johnson 147–630).

old-timer in many ways when he builds or adjusts transmitters in any ham band from 3.5 to 14 Mc. The cost of the entire unit is less than five dollars, and this figure can be reduced by over fifty per cent if you happen to have a suitable tuning condenser in your junk box.

The measuring-cup wavemeter is nothing more than a tuned circuit covering 3.4 Mc. to 15 Mc.

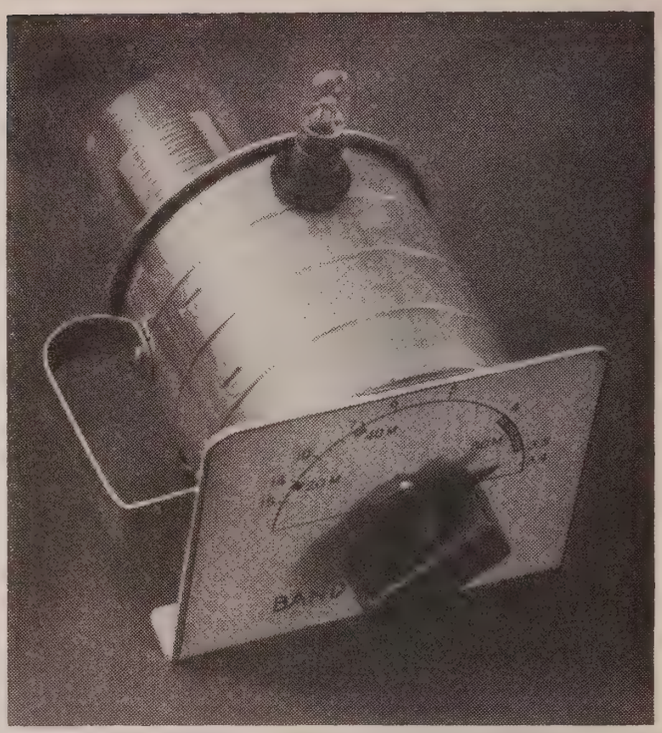

Fig. 10-16—One of the handiest "tools" in ham radio is the absorption wavemeter. This unit, built around an aluminum measuring cup, is designed to fit the requirements of the Novice licensee or old-timer. Construction is simple—the entire assembly is held together with one nut.

with a flashlight bulb in series with it to serve as a resonance indicator. When the coil in the wavemeter is coupled to a transmitter delivering anything from a few watts of r.f. up to a kilowatt and the capacitor is tuned so that the wavemeter is resonant at the frequency of operation, the lamp will light. The unit is calibrated so that the frequency at which the power is being generated is read directly from the dial.

Construction of the wavemeter is extremely easy. The measuring cup is used to provide support for the tuning capacitor and the calibrated dial, incidentally providing a mounting for the indicator lamp and a handle for the entire unit. The lamp is insulated from the cup by mounting it in a grommet-lined ½-inch hole drilled at the top where it will not interfere with the rotation of the plates of the tuning capacitor. The calibration scale is pasted to the face of an aluminum bracket measuring 3½ inches wide and 2⅝ inches high, with a ½-inch lip bent under the cup to form a mounting "foot." This prevents the gadget from rolling off the desk or shelf when stored.

The coil is cemented inside a Quartz-Q coil form 1⅝ inches in diameter and 1⅞ inches deep (Millen 46100). Thus the coil is protected from damage and the operator is protected from the high voltage in the transmitter. The form is mounted ½ inch behind the rear rotor bracket of the tuning capacitor by a machine screw and a spacer. The 6-32 screw fits one of the tapped holes that bolt the ceramic spacer bar to the bracket. An insulated tie-point is slipped under one of the rear stator connectors of the capacitor to serve as the junction point between the tuned circuit and the indicator lamp. One wire from the lamp goes directly to the rotor terminal on the

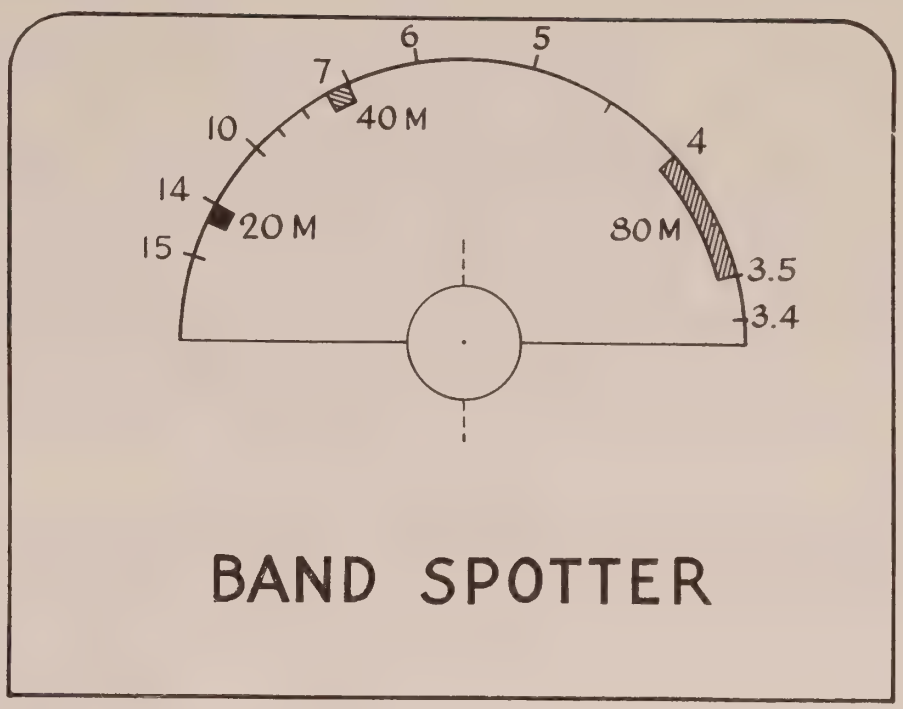

Fig. 10-17 — Actual calibration of the wavemeter. This drawing may be cut out or traced and pasted to the face of the aluminum bracket provided the parts listed below Fig. 10-15 are used in the construction.

rear of the capacitor, the other to the insulated tie-point. The coil is connected from the stator terminal of the capacitor to the lamp at the insulated tie-point.

If you use the same parts we specify below Fig. 10-15, and wire the unit with approximately the same lead lengths shown in the photographs, you will be able to use the calibrated dial scale reproduced in Fig. 10-17. It can be cut out and pasted on the aluminum bracket, or traced onto another sheet of paper. If other parts are used, the wavemeter can be calibrated by using a grid-dip meter in conjunction with a calibrated receiver.

Using the meter is also easy. Assume for a minute that you have tuned up your transmitter, but are not sure that its output frequency is in the desired band. With the transmitter turned on, hold the wavemeter so that the coil is within a few inches of the plate tank coil of your output stage. Turn the tuning dial slowly until the indicator lamp lights, showing that the wavemeter circuit is tuned to the same frequency as the transmitter output. Don't get too close to the tank circuit or you may burn out the indicator lamp.

The same procedure may be followed for any tuned circuit in which power is flowing. Whenever the wavemeter is tuned to the same frequency as the power in the tuned circuit, it will absorb some of that power and then dissipate it in the form of light in the indicator. If the stage you are checking has a plate milliammeter, you can observe the effect of the wavemeter on the tuned circuit to which it is coupled. As the wavemeter is resonated, the plate-meter reading will increase slightly as the wavemeter loads the circuit and takes power from it to light the indicator lamp.

This little gadget cannot be expected to be without its limitations. There are some things that it cannot tell you. For example, its calibration is not accurate enough to permit its use as a frequency meter for close-tolerance reading. It will tell you, however, whether your output is in the 3.5-Mc. range, in the 7-Mc. range (as it would be if you happened to tune up on your second harmonic), or somewhere in between (as it might be if the amplifier was unstable and oscillating by itself). It is for this reason that we call it a *band spotter*, rather than a frequency meter. In the case of a crystal-controlled transmitter, you can be reasonably certain of avoiding off-frequency notices if your crystal is actually in the band, provided that you are sure the output is in the band you think it is. This gadget enables you to be sure.

— *Richard M. Smith, W1FTX*

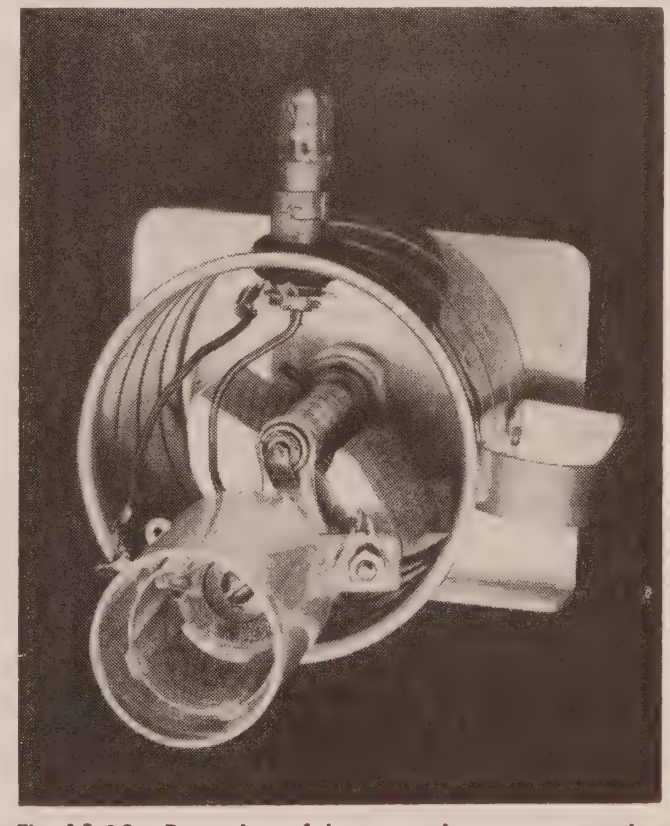

Fig. 10-18—Rear view of the measuring-cup wavemeter. The coil is mounted on the rear of the tuning capacitor inside a protective Quartz-Q form. Also shown is the method of mounting the resonance-indicating lamp in a grommet-lined hole through the side of the cup.

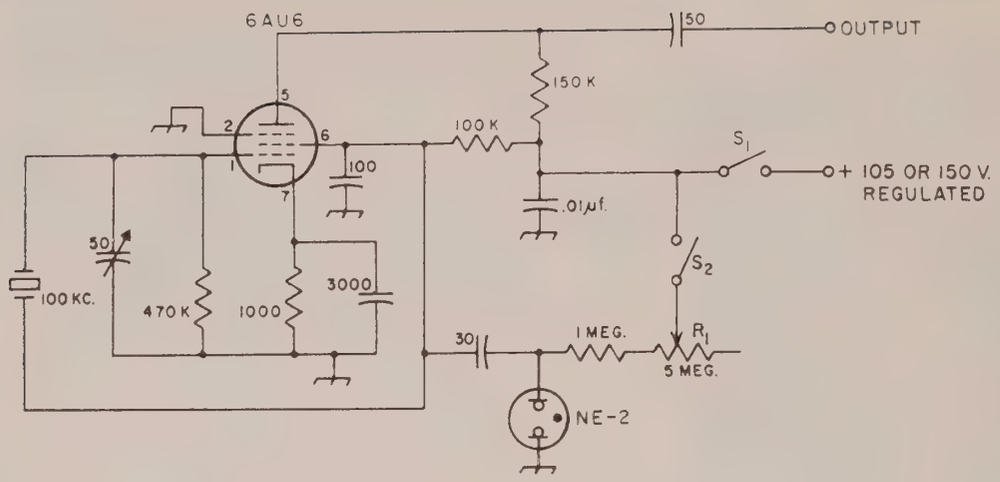

Fig. 10-19 — Diagram of the 100-kc. oscillator with 10-kc. markers. Unless otherwise indicated, capacitances are in μμf. resistances are in ohms, resistors are ½ watt.

100-KC. CALIBRATOR WITH 10-KC. MARKERS

THE versatile neon-bulb sawtooth oscillator can be used to modulate a 100-kc. crystal calibrator and obtain 10-kc. marker intervals. The circuit shown in Fig. 10-19 uses a version of a 100-kc. oscillator found in *The Radio Amateur's Handbook*. However, the circuit may be adapted to fit almost any calibrator.

The neon-bulb oscillator is adjusted to oscillate at 10 kc. by the potentiometer R_1, and its output is coupled to the screen grid of the 6AU6 oscillator by a 30-μμf. capacitor. The resultant beats of the 10-kc. and 100-kc. frequencies produce 10-kc. markers between the stronger 100-kc. points. The neon-bulb oscillator will synchronize or lock in with the 100-kc. crystal-controlled oscillator, making this circuit easy to adjust. The oscillator is set by adjusting R_1 and listening to the calibrator signals on the station receiver. The 10-kc. oscillator may lock in with the 100-kc. oscillator at several settings of R_1, and the setting that gives the optimum signal strength will have to be found experimentally.

—James Bull, W7EIO

MODIFYING THE HEATHKIT MMI FOR MOBILE MEASUREMENTS

THE modification described here will enable an amateur possessing a v.o.m. with a 0-1.5 volt scale to change the range to read 0-15 volts. Most volt-ohmmeters seem to have ranges either too high or too low for measuring the 12 to 14 volts in an automobile. A 0-15 volt range makes mobile voltage measurements more convenient and accurate. A.c. ranges are included in this modification since some generators, such as those manufactured by Leece Neville, have a.c. outputs.

First, subtract the scale to be changed (in this case 1.5) from the scale desired (15 volts, giving 13.5). Multiply this figure by the sensitivity of the basic movement of the meter. In the case of the Heathkit MM1, the sensitivity figure is 20,000 ohms/volt d.c. and 5000 ohms/volt a.c. Multiplication by these factors gives 270,000 for d.c. and 67,500 for a.c. These figures represent the resistance in ohms to be placed in series with one of the leads. It is desirable that these be 1-percent tolerance resistors.

Two methods can be used to insert the resistors in the proper circuit. The easiest and most economical method is to make two external probes, one for d.c. measurements and one for a.c. One end of the resistor is connected to a banana plug that will fit the 1.5-volt meter jack and the other end is connected to the probing wire or lead. A second method is to connect the resistors to a miniature 4-position rotary switch. This switch is mounted on the instrument in the space between the "ohms-adjusting" potentiometer and the —15-amp jack. The wiring diagram is shown in Fig. 10-20.

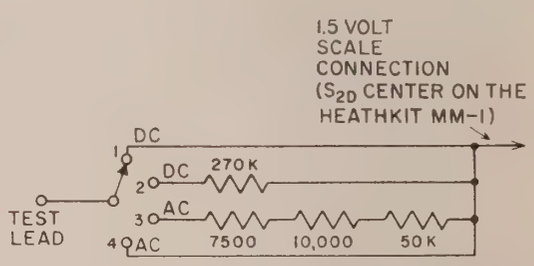

Fig. 10-20—Diagram of the meter circuit. All resistors are ½ watt.

Positions 1 and 4 switch out the resistors so that the meter reads normal. Position 2 allows measurement of 15 volts d.c. and position 3, 15 volts a.c. The resistor for the d.c. scale is a standard value but the 67,500-ohm a.c. unit is not. A combination of resistors can be connected in series to obtain the proper value.

—Maurice I. Sasson, M.D., W2JAJ

11. Hints and Kinks . . .

for Sideband

T.R. SWITCH ARRANGEMENTS FOR 10B AND 20A S.S.B. EXCITERS

Two simple t.r. switch arrangements that should interest those who use Central Electronics s.s.b. exciters are shown in Fig. 11-1. Both of the systems permit automatic break-in with a single antenna by making use of the voice-control relay already included as a part of the type 10B and 20A exciters. Two short lengths of RG-58/U coaxial cable complete the installation shown as section A of the block diagram. Three pieces of coax and a T connector are all that is needed for the system shown in section B. Of course, in either case it is assumed that the antenna (or its tuner) is designed for 50-ohm input.

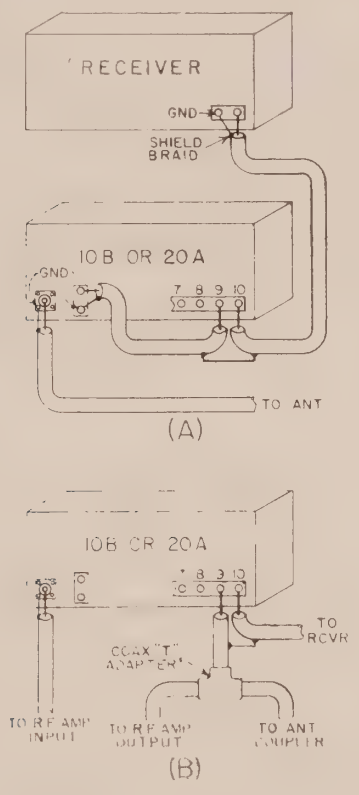

Fig. 11-1—Block diagram of the t.r. switch systems. A is installed when the s.s.b. exciter is worked directly into an antenna. B may be used when the exciter is followed by a power amplifier.

Arrangement A is for use when the s.s.b. exciter is employed as the *complete* transmitter. The cable between exciter and receiver may be any convenient length, but the jumper cable between terminal strips of the exciter should be as short as possible. Notice that the inner conductor of the jumper and the receiver lead are terminated at positions No. 9 and 10, respectively, of the 10-terminal strip located at the rear right-hand corner of the exciters. The outer braid of the two coax leads should be bonded together — but not necessarily grounded — at this point. Terminals No. 9 and 10 of the 10B and 20A units are connected to the internal voice-control relay.

The system shown as section B of Fig. 11-1 may be used when the exciter is followed by a 200–300-watt amplifier. As before, the lead from the receiver is connected to terminal No. 10 of the exciter. Terminal No. 9 of the 10B or 20A is connected through the *shortest* possible length of RG-58/U to the center socket of a standard T connector. Lengths of coax run from the T connector to the output and the input jacks of the r.f. amplifier and the antenna coupler, respectively. Naturally, the load lead may go directly to the antenna if the latter is a 50-ohm affair. Output from the exciter is fed through RG-58/U to the grid circuit of the final.

When installing this t.r. circuit, make sure that the cable between the exciter and T is as short as possible. This does bring the r.f. output lead from the final very close to the exciter unit, but actual operation of the system has resulted in no instability of the r.f. lineup. It is also important that the line between power amplifier and antenna tuner (or antenna) be free of standing waves.

The system shown in section B is used here at W5DLA with the 805 final amplifier running at 225 watts input. It provides voice-controlled break-in without introducing unpleasant plops or other undesirable racket in the output of the receiver.

— J. C. Wallis, W5DLA

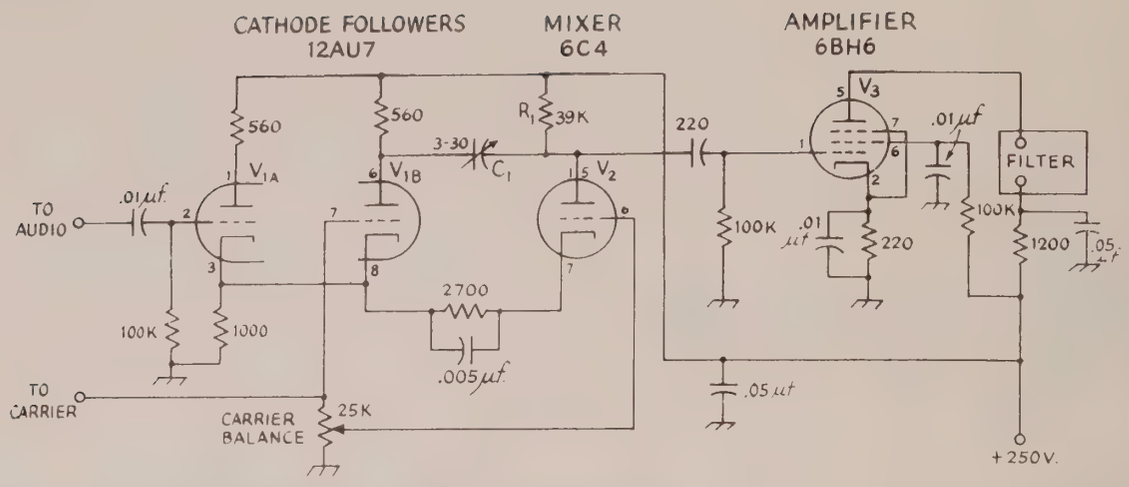

Fig. 11-2 — Diagram of the balanced modulator W9WIO used with the "Edmunds exciter." Unless otherwise indicated, capacitances are in μμf., resistances are in ohms, resistors are ½ watt.

A BALANCED MODULATOR FOR THE W1JEO EXCITER

For the last five years I've been using a W1JEO exciter (*QST*, November 1950) with very good results. Reports were always excellent but I sometimes received comments on a trace of carrier. After being reminded many times about the carrier I decided to install a balanced modulator. I was interested in something simple that could be installed without too much difficulty.

I went back to a technical topic by Byron Goodman, W1DX, in *QST*, February 1957, in which the operation of the Crosby balanced modulator was explained. An article by Dan Healey, W3HEC, in *QST* December, 1957, was also consulted.

After studying the above material I came up with the circuit shown in Fig. 11-2. A conventional amplifier (V_3) was added to the Crosby circuit to boost the output to a higher level. Also, a 39,000 ohm resistor, R_1, was used as a plate load for the mixer instead of an r.f. choke. C_1 is a neutralizing capacitor that compensate for capacitive feedthrough between V_{1B} and V_2.

— *James Zvolanek, W9WIO*

SIMPLE GRID CURRENT INDICATOR FOR CLASS AB LINEAR AMPLIFIERS

The 4–400A Class AB_1 s.s.b. linear amplifier here at W7ETK includes an old but perhaps generally-forgotten method of indicating control-grid current flow. Although the method does not prevent the grids from drawing current, it does provide an immediate visual indication of intermittent current excursions that cannot be followed by a meter. With this system in use, I find it unnecessary to provide especially well-regulated bias voltage for the amplifier.

The circuit consists of a sensitive 8000-ohm relay connected in series with the bias lead to the tubes and a 3.2-volt pilot lamp (No. 1490) controlled by the relay contacts. Voltage for the lamp is furnished by the 5-volt filament transformer for the 4-400As. The relay closes whenever grid current is inadvertently allowed to reach one half ma. or so and, of course, the 3.2-volt lamp operating at 5 volts assures a truly "bright" indication that the linear is being overdriven.

— *W. L. King, W7ETK*

"QUIK-DIP" CRYSTAL CLEANING

In the process of using surplus crystals in Type FT-241 holders, the crystals were checked for oscillating activity in a Pierce circuit. I reasoned that a crystal that would oscillate would serve in the lattice filters. Several, however, did not oscillate. When these were opened, all showed heavy tarnish on the silver plate. These were dipped, as assembled, into "Quik-Dip" (a liquid silverware cleaner) for several seconds, rinsed under running water, and then *very* carefully, so as not to break the fine wires, swabbed to remove the loosened black deposit. Of 8 inactive crystals dipped, 6 were reactivated by this method. Some silver is no doubt removed, so it is best to dunk them no longer than necessary; I used 7 to 12 seconds.

The average frequency of the batch of 6 was measured 330 cycles higher than the average frequency of 7 that were not dipped. "Quik-Dip" is a drugstore item as is the "Q-Tip" medicinal cotton swabs used.

— *W. A. Monahan, W6GTR*

SIMPLIFYING CARRIER NULL ADJUSTMENTS

I was not completely satisfied with the carrier null control on my Central Electronics 20A s.s.b. exciter, since it was rather difficult to adjust.

To obtain greater over-all resolution, I replaced the 1000-ohm carrier null potentiometers with 250-ohm linear potentiometers. I compensated the loss in resistance by adding sufficient resistance to the potentiometers. The resistance values added were obtained by measuring the resistance of the original potentiometers from the slider to each outside terminal (with carrier nulled) and then subtracting 125 ohms (half the resistance of the new potentiometer). I then used the nearest standard value resistor. In my case, this was two 390-ohm resistors on one potentiometer and a 470-ohm and 270-ohm resistor on the other.

This modification resulted in four times the resolution as compared with the original circuit. By using 100-ohm potentiometers, still greater "spread" should be possible.

— *Joe Heumphreus, K6DXW*

CRYSTAL-CONTROLLED 28-MC. OPERATION WITH THE 10A, 10B AND 20A SSB EXCITERS

THE simple circuit shown in Fig. 11-3 provides crystal control for the 28-Mc. output of Central Electronics sideband exciters. The circuit can be built into the v.f.o. cabinet and coupled to the

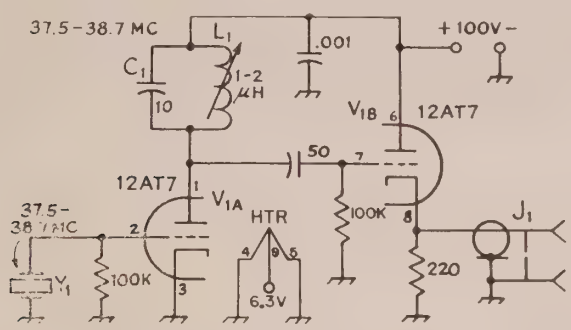

Fig. 11-3—Circuit of W5QMI's crystal-controlled s.s.b. unit. All capacitors less than 0.001 μμf. are in μf. All resistors are ½ watt.

J_1—Coaxial receptacle.

L_1—1–2 μh. slug-tuned (North Hills 120-A or CTC 10-Mc. type. Turns removed experimentally from either type).

Y_1—Overtone crystal. See text.

v.f.o. input terminal of the exciter via coaxial cable.

One half of a type 12AT7, V_{1A}, is used in a conventional triode oscillator circuit. The crystal used with the oscillator is a relatively inexpensive third overtone type manufactured by International Crystal Mfg. Co., Inc. The frequency of the crystal should be in the 37.5- to 38.7-Mc. range, and the tuned plate tank for the circuit, C_1L_1, must resonate at the crystal frequency. A small trimmer capacitor and a 1-μh. inductor may be used in place of the fixed capacitor and the slug-tuned coil.

Output from the oscillator is capacitance coupled to the grid of V_{1B}. This half of the tube works in a cathode follower circuit and provides low-impedance output for feeding directly into the coaxial cable. J_1 is the output connector.

To determine the frequency of a crystal for the oscillator, first select the 28-Mc. frequency that will be used. The crystal frequency will be found by adding the 28-Mc. frequency to 9 Mc., the latter being the frequency supplied by the s.s.b. generator. — *Jim Freund, W5QMI*

MORE ABOUT THE W5QMI S.S.B. UNIT

HERE ARE two suggestions pertaining to the crystal-controlled s.s.b. unit described above.

1) This same oscillator may be used for 21-Mc. operation by installing a 12-Mc. tank in the plate circuit and by using a 12-Mc. crystal. A 47-μμf. mica capacitor in parallel with a North Hills type 120-B (3–5 μh.) inductor should make a suitable tank and, of course, a good ceramic switch should be used for activating either the 12- or the 37.5-Mc. circuits at will.

2) Mount a 50-μμf. variable capacitor on the panel and then connect it across the terminals of the crystal socket. This control will give the operator a little "v.f.o. action" so that he can *zero in* on s.s.b. QSOs near the crystal frequency. — *Jim Freund, W5QMI*

TUBELESS V.F.O. FOR THE 20A S.S.B. EXCITER

A TU-6-B tuning unit from a surplus type BC-191 or BC-375 transmitter may be easily converted into a tubeless v.f.o. for a Central Electronics model 20A s.s.b. exciter. The tuning unit contains all of the parts needed for the v.f.o. and the only expense involved in the entire project is the cost of a few feet of coaxial cable and an output plug.

Section A of Fig. 11-4 shows the tuning-unit circuit before modification. Components labeled C_1, C_2, C_3 and L_1 are the only ones used in the v.f.o. If you happen to have an instruction book for the BC-375 you will find these four components identified with the numbers 601 (L_1), 607 (variable capacitor), 609 and 610 (400-μμf. mica). These parts are located in the left-hand compartment as seen from a front view of the tuner.

The circuit for the v.f.o. is shown in section B of Fig. 11-4. It is quite similar to the circuit described in *QST* for June, 1954. The connection between the oscillator circuit and the exciter is made through two lengths of RG-59/U. These cables add about 20 μμf. per foot across C_2 and C_3, respectively, so the length employed should be no greater than necessary. The inner conductors may be terminated in a 300-ohm plug that will fit the crystal socket. The outer conductors of the cables should be bonded together and grounded at the exciter end.

The only difficulty encountered in the conversion was in unsoldering and resoldering connections due to the mass of metal involved in the large wire, etc. This problem was solved by using two irons simultaneously.

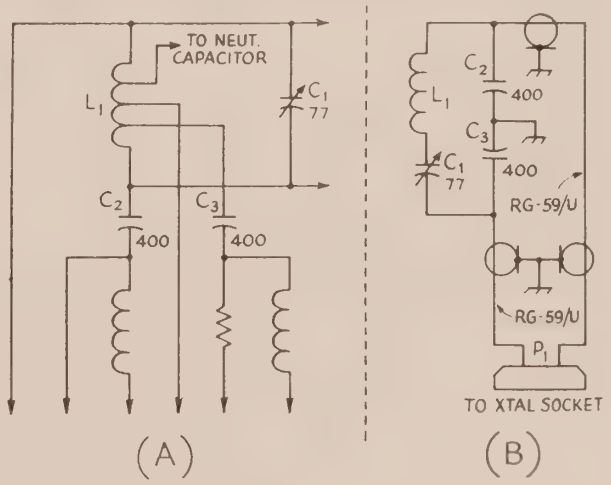

Fig. 11-4—Circuit showing the "before" and "after" wiring of the TU-B-6 tuning unit. W8ZVC uses B as a tubeless v.f.o. for a type 20A s.s.b. exciter. Capacitance values are in μμf.

Stability of the tubeless v.f.o. is excellent and bandspread is adequate. My unit works out to have 496 dial divisions in covering the 5- to 5.5-Mc. range. — *Carl Enix, W8ZVC*

CARRIER INJECTOR FOR PHASING TYPE S.S.B. EXCITER

When using an s.s.b. phasing exciter it is sometimes desirable to inject some carrier without upsetting the carrier balance potentiometers in the balanced modulator. The diagram in Fig. 11-6 shows how this can be accomplished with a minimum of parts.

When the slider of potentiometer R_1 is at the ground end, there will be no carrier injection. However, when the arm is advanced toward the

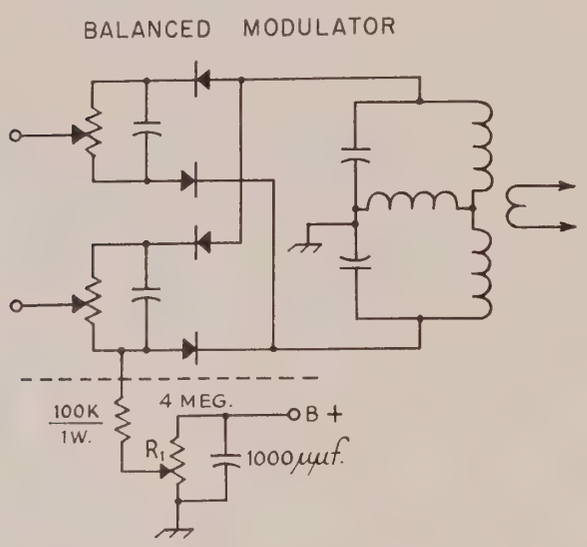

Fig. 11-6—Diagram of the carrier injector.

B-plus end, the circuit will become unbalanced due to positive voltage applied.

Since the 100,000-ohm resistor is in the circuit at all times, a slight carrier unbalance will occur, but this can be overcome by a slight readjustment of the carrier balance potentiometers.

— *W. Lane Tufts, K6JIV*

21-MC. S.S.B. OPERATION WITH THE "W2EWL SPECIAL"

The 14-Mc. version of the "W2EWL Special" can be used for 21-Mc. work after making a simple and inexpensive modification to the rig. This excellent s.s.b. job performs just as well after modification as it did at 14 Mc. The following explains the conversion made here at W5DYK.

The Type 1626 used originally as the v.f.o. tube (V_{10}, Fig. 1, page 18, *QST*, March, 1956) was replaced with a Type 12SN7GT. One half of the dual triode is used as the oscillator tube without any other changes in the oscillator circuit. The second section of the 12SN7GT is wired and used as a frequency doubler. Tuning the oscillator to 6225 kc. gives output from the doubler at 12.45 Mc. The latter mixes with the 9-Mc. s.s.b. signal for output at the high end of the 21-Mc. phone band.

The doubler stage is completely conventional and those interested in making the change will find a suitable circuit in *The Radio Amateur's Handbook*. The plate circuit of the doubler may be slug-tuned.

— *Howard D. Woertendyke, K4QPT*

MODIFIED RECEIVER TUNING RATE FOR S.S.B. RECEPTION

In converting conventional receivers for improved s.s.b. operation, it is desirable to effectively reduce the bandspread tuning range. This is often done by substituting a large diameter knob for the original bandspread control knob. However, in receivers such as the S-40 series, a neat and superior job will result if the bandspread shaft is removed from the set, and the central portion in which the dial cord rides is further reduced in diameter to about 1/16 inch. This is best done on a lathe, or (with care) by placing the shaft in the chuck of an electric drill and using a small flat file, with the drill running. The reduction of shaft diameter decreases the contact area between the shaft and the dial cord, so it may be necessary to wrap the cord around a few extra turns to prevent slippage.

— *Richard A. Schomburg, W7WUM*

BC-221 AS A CARRIER INJECTION GENERATOR FOR S.S.B.

Although already appreciated by many amateurs, newcomers to the ranks of s.s.b. operation may not realize that a surplus BC-221 frequency meter makes an excellent single-frequency carrier generator for reception of single-sideband suppressed-carrier phone signals.

Frequency stability and adequate bandspread, essential requirements of an s.s.b. injection generator, are already built into the various models of the BC-221. Output amplitude control over a wide range, another requisite of a good generator, can be provided for by replacing R_{38} (in Model 221-N) with a 500K potentiometer.

— *Marlin R. King, KP4RC*

12. Hints and Kinks . . .

for the Shack

AN AUTOMATIC "TIMER" FOR THE 10-MINUTE STATION BREAK

SECTION 12.82 of the FCC rules governing amateur radio is quite specific about the need for identifying an amateur radio station by the transmission of its call sign at least every ten minutes or as soon thereafter as possible. Unfortunately, even the most conscientious operator may inadvertently violate this regulation if he gets tied up in an interesting QSO or a lively moving round-table such as takes place in the s.s.b. circles.

One obvious solution of the problem is the use of an automatic operating aid that either "sounds off" or "flashes" at ten-minute intervals. Recently, both W5JPM and W5MAW figured out a way of building a simple *ten-minute timer* around an electric alarm clock.

Several models of the General Electric and Telechron "boudoir" electric alarm clocks have a time-setting knurled brass knob that makes six revolutions in each hour. In other words, the knob makes one complete revolution every ten minutes. It is no trick at all to solder a lug or arm to the knob and then use this projection to actuate a Microswitch. The switch may be mounted on the rear of the clock and can be wired to control either a ten-minute flasher, a bell or a buzzer.

It is suggested the mechanical layout provide for warning *on-the-hour* and at ten-minute intervals thereafter. Then, if we all synchronize our clocks with the aid of WWV, we won't all be identifying at different times in the same QSO.

Nice thing about the modification is that it does not affect the clock value and the alarm feature is still usable.

— Jack E. Cox, W5JPM
John S. Jinkins, jr., W5MAW

Editor's Note: It doesn't take much imagination to realize that W5JPM and W5MAW have come up with an idea that may solve the "conelrad" problem for some of the gang. After all, as long as you *remember* to check the broadcast band every ten minutes you're *in business* as far as conelrad compliance is concerned.

ILLUMINATED CALL LETTER BOX

HERE'S an evening's project that will put some life in your shack and also give a few hours of enjoyable construction time. The gimmick shown in Fig. 12-1 is constructed in a 2¼ × 2¼ × 4-inch Minibox. The desired opening on the front panel is first scribed; four corners of the proposed cutout are drilled with a ⅜-inch bit to produce round corners and the front panel

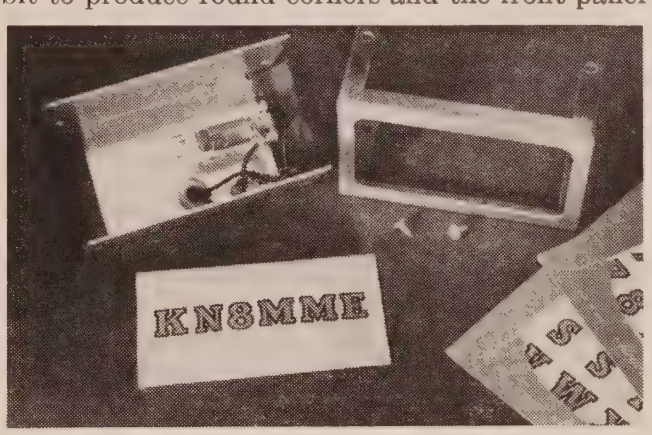

Fig. 12-1—K8MME's illuminated call letter box.

is then cut out with a small metal saw or hacksaw blade.

Letter and numeral decals, obtainable from most dime stores, are transferred to a sheet of white plastic or translucent material. This sheet is cut to fit snugly behind the opening in the front panel. When the Minibox is reassembled, it will automatically hold the plastic tight. Two felt strips are cemented inside the back section of the box to prevent light leaks.

A pilot lamp and matching socket are mounted inside the box. Power feed wires are fed through a grommeted hole in the back. Power leads can be connected to the receiver heater circuit so that the panel will be illuminated whenever the receiver is turned on. Another scheme would be to control the light with the station send-receive switch. The box would be illuminated during transmitting, giving a visual "on-the-air" indication.

— John Howard, K8MME

SIMPLIFIED VERSION OF W6CHB'S TRANSISTORIZED CODE-PRACTICE OSCILLATOR

THE circuit shown in Fig. 12-2 is a simplified version of the transistorized code-practice oscillator described in *QST* for June, 1954. Comparison of the original and the new circuits will

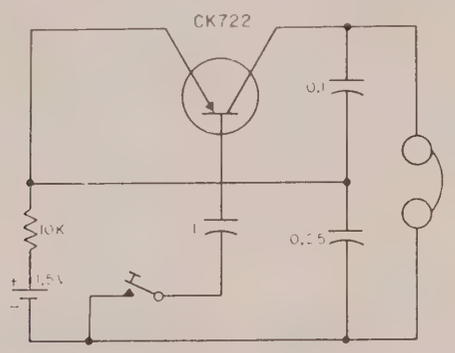

Fig. 12-2—WØJV's version of the transistorized code-practice oscillator. High-impedance phones (4000 ohms) should be used with the circuit.

show that the principal change is the substitution of a pair of headphones for the tank inductance used by W6CHB.

The circuit of Fig. 12-2 requires no resistor across the capacitor in the base lead of the CK722. Current drain is not in excess of 500 microamperes with a 1.5-volt battery in use. Additional volume may be obtained by employing a 3-volt battery. Incidentally, the original circuit can be used with the phones replacing L_1.

— *George S. Carson, WØJV*

A TWO-STATION TRANSISTORIZED CODE-PRACTICE OSCILLATOR

THIS code-practice oscillator embodies such features as compactness, economy, simplicity, tone control and dual-position operation. The unit can be built for approximately $7.00, takes up no more space than that occupied by a pair of surplus keys and may be keyed and monitored at both the "main station" and "remote" operating positions.

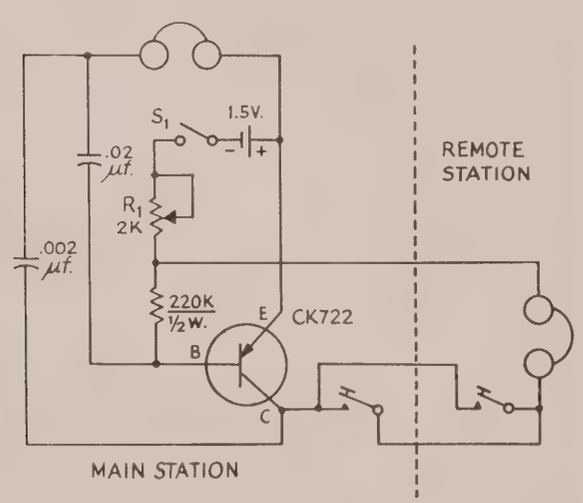

Fig. 12-3—Circuit of the two-station transistorized code-practice oscillator.

The circuit of the oscillator is shown in Fig. 12-3. The parts for the main station may all be mounted on the base of a surplus type J-38 key. R_1 is a 2000-ohm potentiometer (tone control) equipped with a s.p.s.t. switch (S_1). The phones at both positions should have an impedance of 1000 to 2000 ohms. Battery potential may be increased to 3 volts if the 1½-volt source gives less than the desired amount of audio output.

A 3-wire cable connected between stations will permit two operators to work "break-in." The operating positions may be separated by any reasonable distance.

— *William W. Clarke*

MORE ABOUT W1ICP's TRANSISTOR CODE-PRACTICE SET

THE circuit shown in Fig. 12-4 is a modified version of the one described by McCoy in *QST* for May, 1956. This arrangement has more audio output than did an exact duplicate of the original model, and it uses a junk-box filament trans-

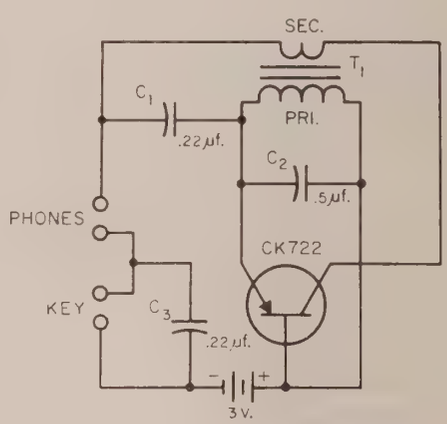

Fig. 12-4—Circuit of the transistor code-practice set described by W8KX. T_1 is a small 6.3-volt filament transformer.

former instead of a universal output transformer. C_2 has been added in the interest of increased audio output, and C_3 suppresses key clicks that show up without the capacitor.

Connecting the 0.5-μf. capacitor across the filament transformer does cause the oscillator to generate a different tone than that emitted by W1ICP's unit. Howevery, the frequency or pitch of the signal can still be varied by increasing or decreasing the capacitance of C_1.

— *Walt Strauss, W8KX*

—···—

FIG. 12-5 is the circuit of a transistorized code-practice oscillator that *started out* to be a duplicate of the one described in *QST* for May, 1956. It now has a pair of resistors and a couple of capacitors not used in the original set, but it does use the same transformer and transistor.

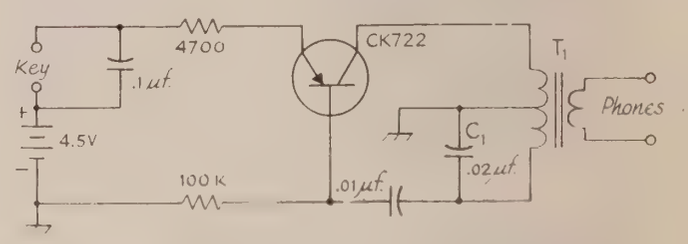

Fig. 12-5—Schematic of W3UYC's transistorized code-practice oscillator. Resistances are in ohms; resistors are ½ watt. Capacitors are paper. T_1 is a Merit type A-2900 universal replacement output transformer.

The alterations can be easily made by anyone who has constructed the 1956 model, and an improvement in tone and the elimination of sharp key clicks will be the reward. The output of the modified unit is nearly a sine wave. The circuit draws only about 0.5 ma. from a 4.5-volt battery, it follows a bug at high speed and it will work with headphones of almost any impedance. The tone can be changed by varying the capacitance of C_1 in steps of 0.01 μf.

— *George Messenger, W3UYC*

SIMPLE SETUP FOR CODE PRACTICE

Some of the newcomers who have need for simple code-practice equipment may solve their problems by hooking a pair of phones, a key and

Fig. 12-6—This combination of headphones, key and phone plug, plus a receiver with b.f.o., can be used for code-practice work as suggested by W8CGF.

a phone plug in series as shown in Fig. 12-6. After this combination is plugged into a receiver, close the key, turn on the b.f.o. and then tune to a steady signal, such as WWV or the carrier of a broadcast or Loran station. Naturally, you *key* the signal just as you would the output from a conventional practice oscillator.

— *Frank Fahrlander, W8CGF*

TRAINING AID FOR THEORY INSTRUCTION

In teaching theory to prospective hams, the writer uses a specially prepared schematic of a typical Novice transmitter. The diagram is drawn on a large sheet of oilcloth which can be rolled up for carrying or storage. The circuit is drawn in black on white material because the sharp contrast of this color scheme presents the circuit in a lucid and impressive manner. In labeling the chart, all components are identified by standard circuit symbols.

Those who wish to make one of these chart-type schematics should obtain a large piece of white oilcloth (about 26 by 30 inches) and some black enamel paint. This type of paint is available in small quantities and may be applied to the white background with a small camel's-hair brush.

When drawing the circuit, leave enough room at one end of the chart so that it can be attached, without disfiguring the schematic, to a cardboard tube. The tube serves as a support for hanging the chart and will also protect the oilcloth when it is rolled up. Frequently, a tube can be obtained from the oilcloth dealer. A second tube, one having a diameter large enough to fit over the rolled-up chart, makes an ideal carrying case for the schematic.

The chart-type diagram is really a great aid in presenting simple theory in *black and white* to Novice candidates and most certainly helps in teaching them how to interpret the radio symbols most commonly used.

— *Carolyn J. Hull, W2YCX*

MOUNTING QSL CARDS

A solution to the problem of mounting and displaying QSL cards without damaging or defacing them is shown in Fig. 12-7. The method also permits easy removal or replacement of individual cards.

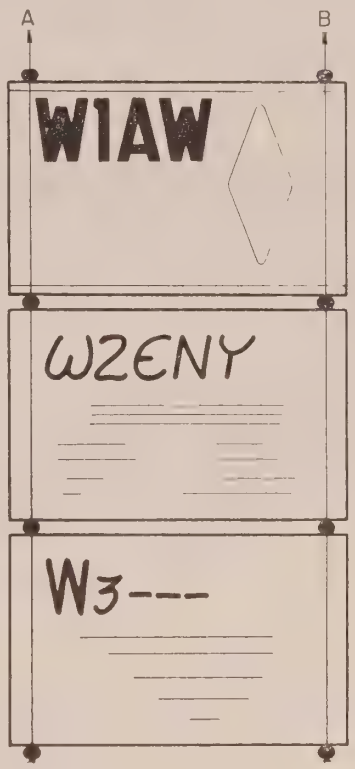

Fig. 12-7—Sketch showing W2ENY's method of displaying QSL cards. Threads shown at the right and left are backed up by threads which run up along the rear side of the cards. Vertical extensions A and B should be long enough to reach the nails, thumbtacks, rod or rings used to support the strip.

The cards are suspended in vertical strips by means of two pairs of fine thread, each about ½ inch in from the edge of the cards. Small glass or plastic beads of the type used by children in making designs are used as separators between each pair of cards. Knot each pair of threads to support the beads at the bottom and clamp the threads extending above the uppermost card with another pair of beads. The supporting strings may be tied to a dowel or curtain rod, or they may be terminated in small rings fastened to the wall or other surface.

— *P. S. Christaldi, W2ENY*

QST ARTICLE INDEXING HINT

If the table of contents is removed from each issue of *QST* and pasted or filed in a loose-leaf binder, it simplifies the task of locating articles or subjects that have been presented in back issues of the magazine. This monthly indexing system is particularly helpful during a current year, prior to the appearance of the annual index in the December issue.

— *Charles Stouth*

ANOTHER QSL CARD DISPLAY METHOD

MOUNTING QSLs on walls without marring wall paper, paint, or damaging the QSLs is always a problem. One solution is to mount the QSLs with folded stamp hinges, the type used by stamp collectors for mounting stamps. Put a hinge on the back of the corner of each QSL, wet the other half of the hinge and hold in place for a few seconds. After the hinges are dry they will hold the QSL in place indefinitely, and they may be removed when dry without the slightest danger to walls or cards.

— *Mike Kaufman, K6VCI*

SPECIAL INK FOR SMOOTH-SURFACED QSL CARDS

ANYONE who has tried writing on the slick side of smooth-surfaced QSL cards with an ordinary fountain pen or ball-point pen has probably experienced considerable annoyance getting the ink to *take* to the surface properly. I have found that Carter's Cloth Marker (a ball-point pen with a heavy jet black ink) is the ideal solution to this problem. This inexpensive pen writes with a slightly heavier line than the ordinary pen and the ink is really indelible.

— *Sam Goldish, W5TVG*

IS YOUR STATION UNDERWRITERS' LAB APPROVED?

THE National Electrical Safety Code, Pamphlet 70, Standard of the National Board of Fire Underwriters, deals with electric wiring and apparatus. The Code was set up to protect persons and buildings from the electrical hazards arising from the use of electricity, radio, etc. Article 810 is entitled "Radio Equipment." The scope of this article, Section 8101, says, "The article applies to radio and television receiving equipment and to amateur radio transmitting equipment, but not to the equipment used in carrier-current operation." Without reading further, most amateur stations comply with these safety rules, not because they are required to do so, but because of the inherent nature of the ham to provide great safety factors in most of his equipment. It is to the one in a hundred, where the safety factor is doubtful, that these articles will be helpful. It will be seen later that not only do these articles satisfy the Underwriters' Code but, when fulfilled, some are measures that one would take to TVI-proof his rig. So it's a matter of killing two birds with one stone.

The Board of Fire Underwriters sets up the code as a minimum standard for good practice. Most cities adopt the code, or parts of it, either entirely or with certain amendments which may apply to that particular city. It is up to the city to enforce these rules. When a violation is reported, periodic checks are made by an inspector until a correction is made and to insure against future recurrence.

Antenna Systems Sections 8111–8115

"Antenna-counter-poise and lead-in conductors shall be of hard copper, bronze, aluminum alloy, copper-clad steel, or other high-strength, corrosion-resistant material. Soft-drawn or medium-drawn copper may be used for lead-in conductors where the maximum span between points of support is less than 35 feet. Outdoor antenna, counter-poise and lead-in shall not be attached to poles or similar structures carrying electric light or power wires or trolley wires of more than 250 volts. Insulators shall have sufficient mechanical strength to safely support the conductors.

"Outdoor antenna, counter-poise and lead-in shall not cross over electric light or power circuits and shall be kept away from all such circuits so as to avoid the possibility of accidental contact.

"Where the proximity to electric light and power service conductors of less than 250 volts cannot be avoided, the installation shall be such as to provide a clearance of at least two feet. It is recommended that antenna and counter-poise conductors be so installed as not to pass under electric-light or power conductors.

"Splices and joints in antenna and counter-poise spans shall be made with approved splicing devices or by other means as will not appreciably weaken the conductors. Soldering may ordinarily be expected to weaken the conductor; therefore, soldering should be independent of the mechanical support.

"Metal structures supporting antennas shall be permanently and effectively grounded."

Antenna Systems — Receiving Stations Sections 8121–8124

"Outdoor antenna and counter-poise conductors for receiving stations shall be of a size not less than in the following table:

	Minimum Size of Conductor When Maximum Span is . . .		
Material	*Less than 35 feet*	*35–150 feet*	*Over 150 feet*
Aluminum alloy, hard-drawn copper	19	14	12
Copper-clad steel, bronze or other high-strength material	20	17	14

"Lead-in conductors from outside antenna . . . shall be of such size as to have a tensile strength at least as great as that of the antenna conductors (as in the table).

"Lead-in conductors attached to buildings shall be so installed that they cannot swing closer than two feet to the conductors of circuits of over 250 volts, or less; or ten feet to the conductors of circuits of more than 250 volts. . . .

"If an electric supply circuit is used in lieu of an antenna, the device by which the radio receiving set is connected to the supply circuit shall be specially approved for the purpose."

Antenna Systems — Transmitting Stations Section 8131-8135

"Antenna and counter-poise conductors for transmitting stations shall be of a size not less than given in the following table:

	Maximum Size of Conductors When Maximum Open Span is . . .	
Material	*Less than 150 feet*	*Over 150 feet*
Hard-drawn copper.....	14	10
Copper-clad steel, bronze or other high-strength material	14	12

Lead-in conductors shall be of a size as specified in the table, for maximum span lengths.

"Antenna and counter-poise conductors for transmitting stations attached to buildings shall be firmly mounted at least three inches clear of the surface of the building on non-absorptive insulating supports such as treated pins or brackets, equipped with insulators having not less than three-inch creepage and air gap distances. . . .

"Entrance to buildings . . . except where protected with a continuous metallic shield which is permanently and effectively grounded, lead-in conductors for transmitting stations shall enter buildings by one of the following methods:

"a. Through a rigid, non-combustible, non-absorptive tube or bushing.

"b. Through an opening provided for the purpose in which the entrance conductors are firmly secured so as to provide a clearance of at least two inches.

"c. Through a drilled windowpane."

Transmitting Stations Section 8192

"Transmitters shall comply with the following:

"a. Enclosing. The transmitter shall be enclosed in a metal frame or grille, or separated from the operating space by a barrier or other equivalent means, all metallic parts of which are effectively connected to ground.

"b. All external metallic handles and controls accessible to the operating personnel shall be effectually grounded. No circuit in excess of 150 volts should have any parts exposed to direct contact. A complete dead-front type of switchboard is preferred.

"c. Interlocks on doors. All access doors shall be provided with interlocks which will disconnect all voltages in excess of 350 volts when any access door is opened.

"d. Audio amplifiers. Audio amplifiers which are located outside the transmitter housing shall be suitably housed and shall be so located as to be readily accessible and adequately ventilated."

How many hams have transmitters unenclosed or without interlocks or both?

The author has purposely visited over a dozen ham shacks and there are some who do not comply with various provisions. Of course, no particular station will be shut down because the antenna lead-in is No. 16 instead of No. 14, or because the speech amplifier is not totally enclosed. The National Electric Code is only a minimum standard, and compliance with its rules will assure less operating failures and hazards, and greater safety.

A copy of the pamphlet is available by writing the National Board of Fire Underwriters in your city, or at 85 John Street, New York 38, New York. Ask for pamphlet No. 70.

Other parts of the Underwriters' Code deal with power wiring and, in addition to the requirement of the use of U.L. approved materials and fittings, have the following to say of direct interest to amateurs:

"All switches shall indicate clearly whether they are open or closed.

"All (switch) handles throughout a system . . . shall have uniform open and closed positions.

". . . supply circuits shall not be designed to use the grounds normally as the sole conductor for *any part* of the circuit."

The latter means that wire conductor should be used for all parts of the power circuit. Dependence should not be placed on water pipes, etc., as one side of a circuit.

— *I. F. Wolk, W6HPV*

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